.31

Railway Mechanical Engineer

November
1945

THE LIBRARY OF CONGRESS SERIAL RECORD
NOV 1 - 1945

Interlocking

WINE

DROP END LOCK

FOR ALL DROP END GONDOLA CARS

THE WINE RAILWAY APPLIANCE CO.
TOLEDO 9, OHIO

UNIT Newsletter

No high pressure promises-no super salesmanship-but millions of grueling test miles under every possible service condition sold these 29 railroads and private car companies on Unit Trucks...

AKRON, CANTON & YOUNGSTOWN
AMERICAN REFRIGERATOR TRANSIT
★ ATLANTIC COAST LINE
BALTIMORE & OHIO
† CENTRAL OF GEORGIA
★ CHICAGO, BURLINGTON & QUINCY
CHICAGO AND NORTHWESTERN
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DENVER & RIO GRANDE WESTERN
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GRAND TRUNK WESTERN
† GULF MOBILE AND OHIO
LOUISVILLE & NASHVILLE
★ MISSOURI PACIFIC LINES
NASHVILLE, CHATTANOOGA AND ST. LOUIS
NEW YORK CENTRAL SYSTEM
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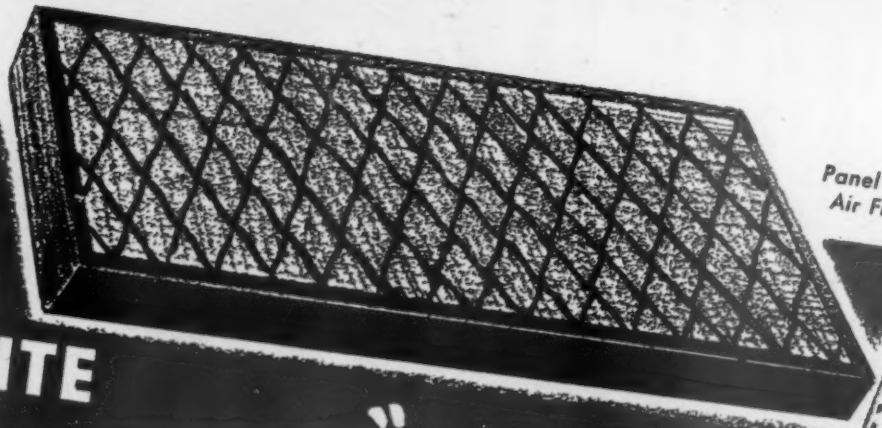
NORFOLK & WESTERN
† ROCK ISLAND LINES
SEABOARD AIRLINE
UNION TANK CAR COMPANY
VIRGINIAN RAILWAY
WESTERN FRUIT EXPRESS
WESTERN MARYLAND
WILSON CAR LINES

(†) Over 1000 Unit carsets in use.
(★) Over 4000 Unit carsets in use.

UNIT TRUCK CORPORATION
[illegible] York 6, N. Y.
[illegible] treet



Panel Type Air Filter

OAKITE "ON TIME" FILTER CLEANING

FASTER . . . EASIER Way to Clean Diesel Filtering Units

Lube Oil Filter Unit

Sinter Bronze Type Filter Unit

If you want a successful, low-cost procedure for cleaning Diesel lube oil, fuel oil and air filtering units, ask us to send you data describing how fast-working Oakite materials enable you to expedite this important maintenance work more easily on a MASS PRODUCTION basis.

Already used on many Class 1 roads, these specialized Oakite materials and easily installed techniques are today's best and most practical answer to the efficient cleaning and maintenance of filter units.

"KEEP POWER ROLLING"

ASK US ABOUT TIME-SAVING OAKITE METHODS FOR:

- Cleaning Valve Gear
- Degreasing & Decarbonizing Diesel Engine Pistons
- Back Shop Tank Degreasing
- Reclaiming Triple-Valve and Other Rubber Gaskets
- Washing Engine Tanks & Cabs
- Descaling Diesel Cooling Systems Safely
- Cleaning Air Compressors

Sinter Bronze and Doughnut Type Filters

In addition to helpful diagrams . . .drawings . . . working details, a special chapter in this Service Report deals with sinter bronze and Doughnut type Diesel filters and time-saving methods for cleaning and reconditioning them. Also included is an effective set-up for economically cleaning panel or box type air filters on a mass production basis. This factual Oakite Service Report is FREE to all Mechanical Supervisors . . . write for it TODAY!

OAKITE PRODUCTS, INC., WRIGLEY BUILDING, CHICAGO 11, ILL.

In Canada: OAKITE PRODUCTS OF CANADA, LTD.
TORONTO: 65 Front St. East—MONTREAL: 1 Van Horne Ave.

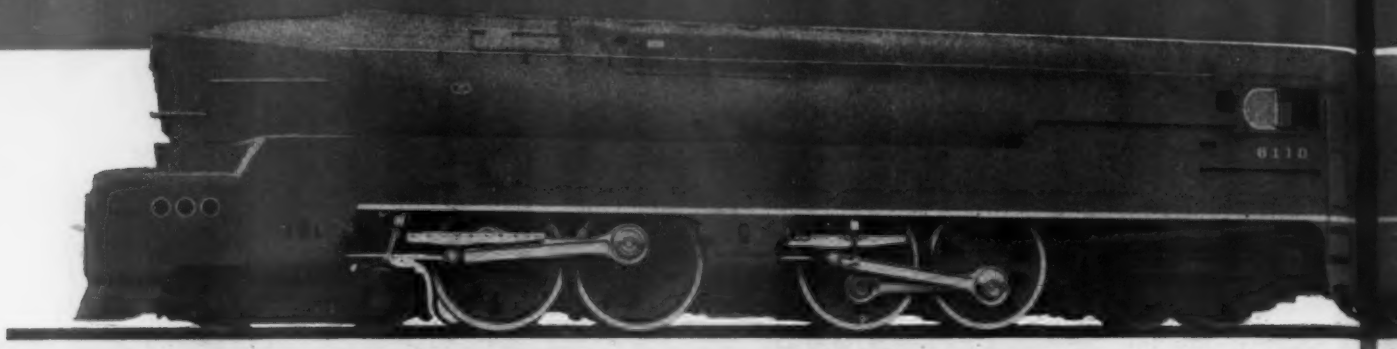
OAKITE

THEIR MARK REG. U.S. PAT. OFF.

RAILWAY SERVICE DIVISION

Published monthly by Simmons-Boardman Publishing Corporation, 1309 Noble Street, Philadelphia, Pa. Entered as second-class matter, April 3, 1933, at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription price, $3.00 for one year, U. S. and Canada. Single copies, 35 cents. Vol. 119, No. 11.

AMERICA'S NEWEST STEAM



America's first gear-driven steam turbine locomotive, built by Baldwin with turbines and gears by Westinghouse.

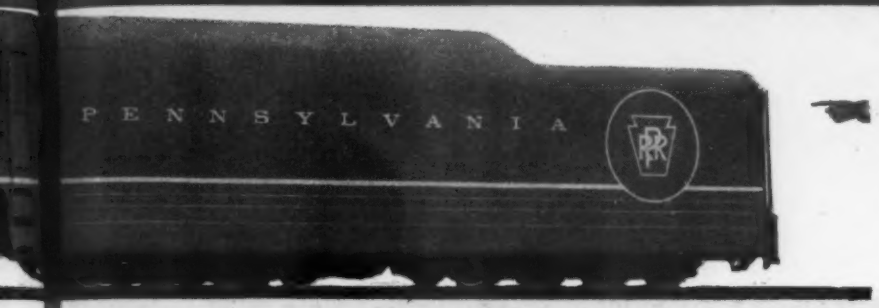
There is nothing static about locomotive design and construction—and this goes for all types—steam, diesel-electric, electric, and others still to come. Constant research on the part of the locomotive builder and the railroads is taking care of that.

The new and improved locomotives now coming from the Baldwin shops are tangible evidence of this constant progress in the locomotive art—leading to higher efficiencies, greater availability, and lower operating and maintenance costs.

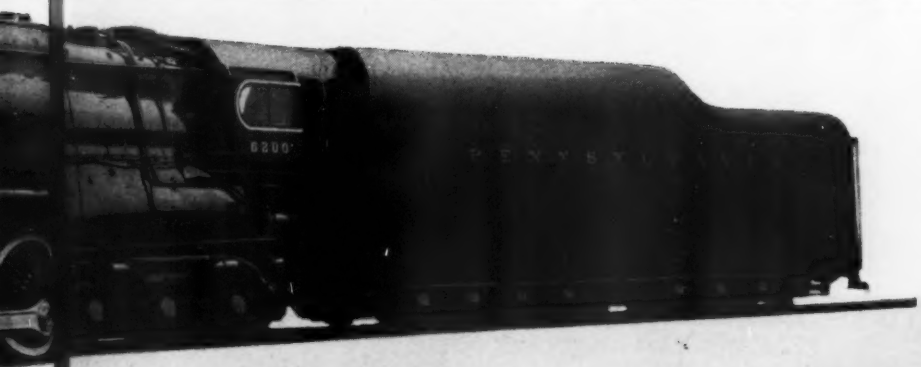
Our engineering staff will welcome the opportunity to study your motive power problems and advise you how these new locomotive types may be of service. The Baldwin Locomotive Works, Locomotive and Ordnance Division, Philadelphia, Pa. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, Detroit, St. Louis, San Francisco, Houston, Pittsburgh.

BALDWIN SERVES THE NATION WHICH THE RAILROADS HELPED TO BUILD

AND DIESEL LOCOMOTIVES



Four-cylinder Duplex locomotive, offering improved performance at all speeds with outstanding advantages at high speeds.



Baldwin-Westinghouse, 2000-hp. diesel-electric locomotive—the newest thing in the diesel field for main line service.

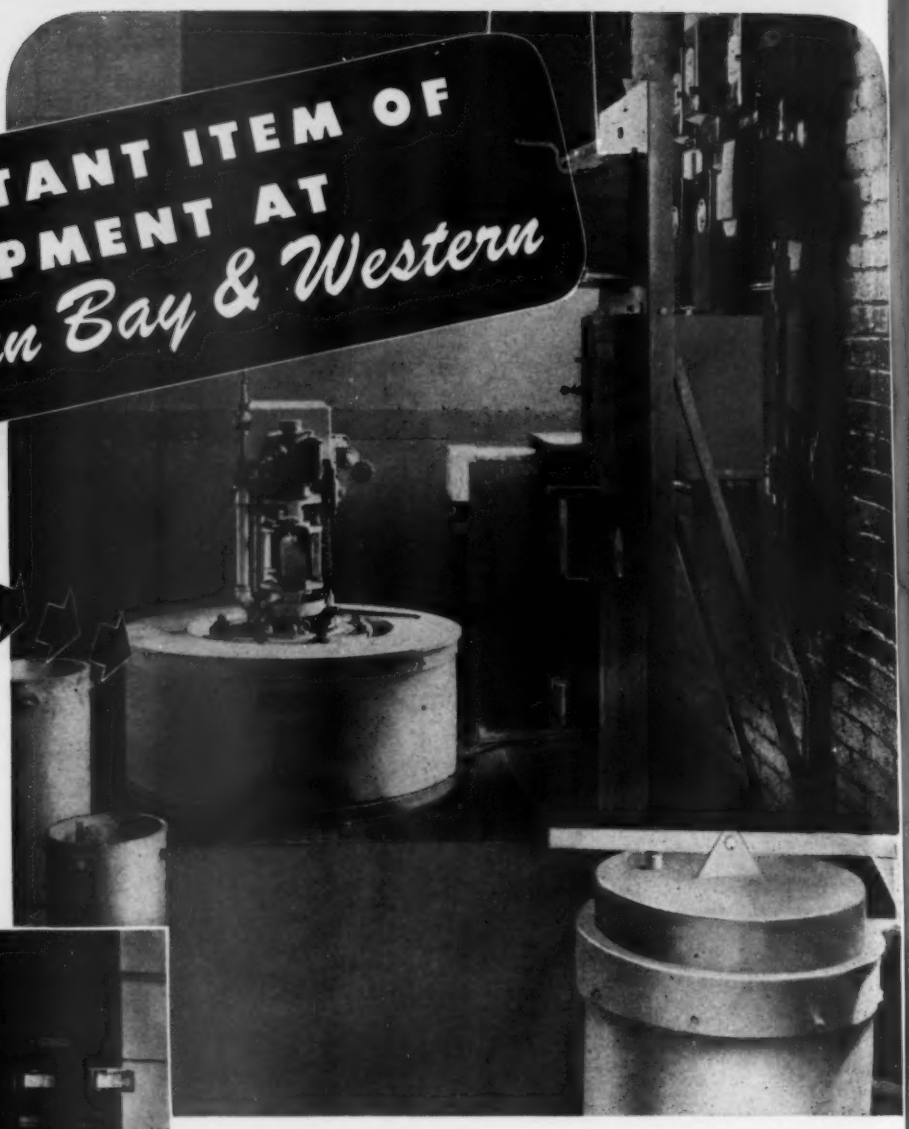
BALDWIN

LOCOMOTIVES

BALDWIN PRODUCTS FOR THE RAILROADS — Steam, diesel-electric and electric locomotives, Diesel engines, Hydraulic presses, Special railroad shop equipment, Testing machines and instruments, Steel tires and rolled steel wheels, Crane wheels, Connecting rods and other steel forgings, Steel castings, Springs, Metal plate fabrication, Boilers, Non-ferrous castings, Bending rolls, Plate planers, Dynamometer cars

BLW THE BALDWIN GROUP

AN IMPORTANT ITEM OF NEW EQUIPMENT AT *Green Bay & Western*



Two photos of the Green Bay and Western Railway's Carburizing installation.

The illustrations show the Hevi Duty Electric Vertical Retort Furnace recently installed in the Green Bay and Western's blacksmith shop at Green Bay, Wisconsin. As an important factor in the speedy production of maintenance parts, this flexible furnace, for use in carburizing, hardening and annealing, gives to the maintenance shop an all purpose, precision heat treating unit. Operating costs are low. There are numerous sizes of this type and other Hevi Duty heat treating furnaces for production maintenance

Ask for Detailed Bulletins . . . Today!

HEVI DUTY ELECTRIC COMPANY

HEAT TREATING FURNACES HEVI DUTY ELECTRIC EXCLUSIVELY

MILWAUKEE, WISCONSIN

BOLT TENSION lengthens car life

The wood under the head of an M-F Water-tight Bolt is compressed . . . not counter sunk. It maintains the bolt in constant tension . . . a necessity in producing long-lived car construction.

The M-F Water-tight Bolt presents visual evidence that it is properly applied . . . evidence that is not readily available with other applications.

To obtain the proper tension, the head of the Water-tight Bolt must be pulled down until it is flush with the surrounding surface.

You can always tell when an M-F Water-tight Bolt is under tension . . . the head is flush with the surface surrounding.

"M-F" Lock Nuts . . . Water-tight Bolts . . . Lock-tight Floor Clips . .. Collar Bolts. Small items, but their proper application insures long-lived cars.

MAC LEAN-FOGG LOCK NUT COMPANY

2649 N. Kildare Avenue, Chicago 39, Illinois • ***In Canada: The Holden Co., Ltd., Montreal***

For low-cost, efficient ash-handling . . . the Whiting Electric Cinder Conveyor

SINGLE- AND MULTIPLE-TRACK MODELS AVAILABLE • NO CHUTES, APRONS, OR BAFFLES REQUIRED

Whiting Electric Cinder Conveyors, designed from suggestions made by railroad officials themselves, meet all railroad requirements. Drive mechanisms are at ground level for easy inspection and maintenance, and the elimination of chutes, aprons, and baffles assures permanent clearance. Simple, rugged, dust-proof construction contributes to their high-speed, high-capacity protected operation, and long-service life with reduced maintenance cost. Oversize hoppers —various capacities—for single and multiple tracks. Write for details.

WHITING
CORPORATION

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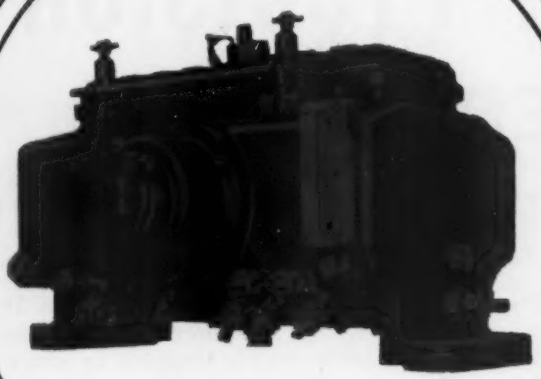
RAILROAD MAINTENANCE EQUIPMENT

DROP PIT TABLES • LOCOMOTIVE HOISTS • HIGH-LIFT JACKS • LOCOMOTIVE SPOTTERS CAR WASHERS • CINDER CONVEYORS • TRANSFER TABLES • CROSSOVER BRIDGES

Offices in Chicago, Cincinnati, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, and Washington, D. C. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario.

NATHAN



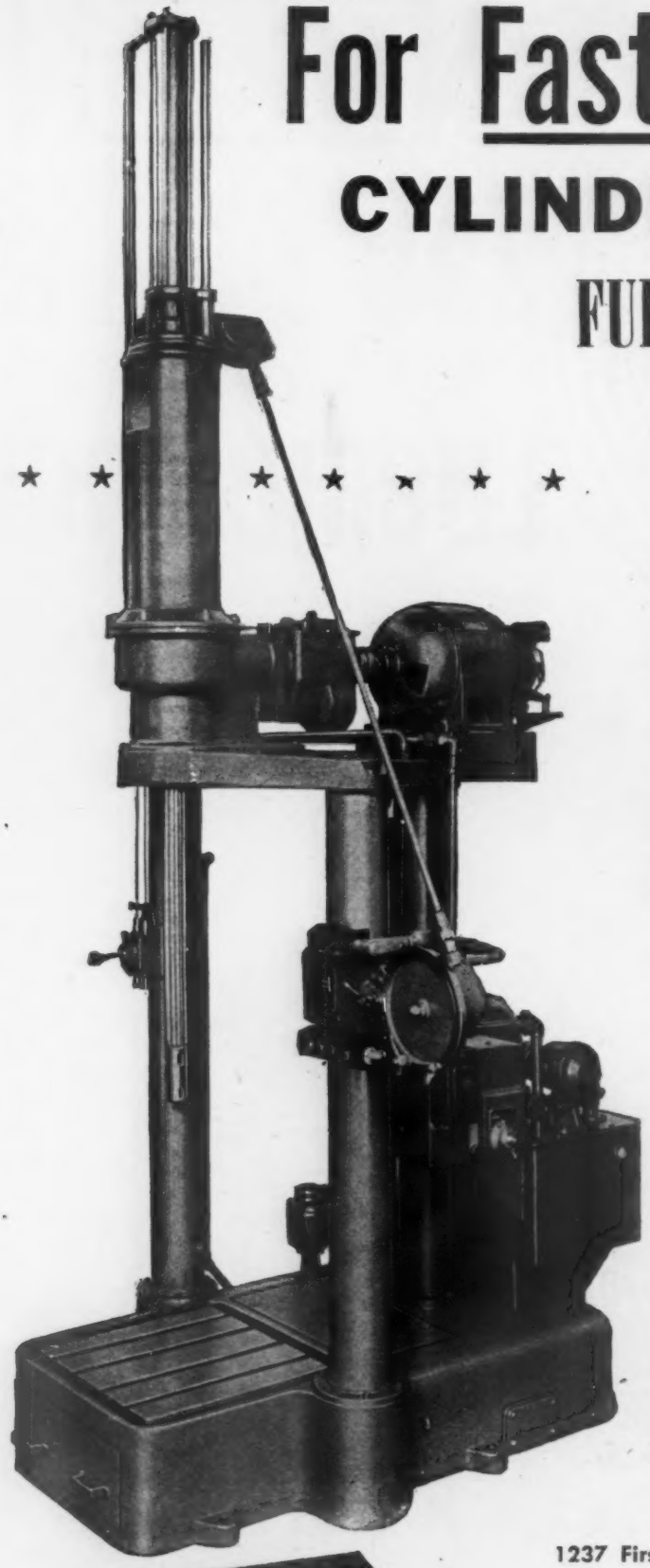
230 POINTS *of* LUBRICATION

THE Virginian 2-6-6-6 is another outstanding example of efficient locomotive lubrication illustrating the great precautions mechanical men are taking to protect locomotive performance and to increase availability. Four NATHAN DV-8 Mechanical Lubricators — and NATHAN Distributors — deliver lubricating oil to and prevent frictional wear at 230 vital points on these locomotives.

Mechanical Lubrication pays big dividends, and the operating and maintenance economies increase in proportion to the scope of applications. The more the points of lubrication — the greater the savings.

NATHAN MANUFACTURING CO., 250 PARK AVE. NEW YORK 17, N. Y.

For Fast, Precision
CYLINDER HONING
FULMER HONING MACHINE



The Fulmer Honing Machine can finish Diesel or any other type of cylinders to precision accuracy much faster than is possible by any other means. It saves time and reduces maintenance costs.

Wide range of spindle and reciprocating speeds permits honing small or large diameters within the range capacity of the machine, with strokes up to 72" and cylinder diameters up to 20" bore. Larger capacity on special order.

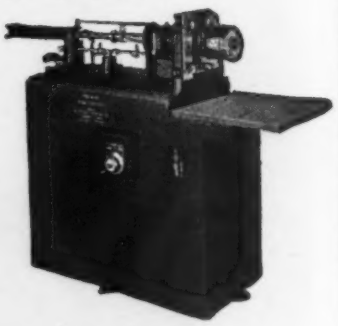
Simple to operate . . . extremely flexible . . . fast stock removal . . . precision accuracy . . . any surface finish desired—all obtainable with the Fulmer Honing Machine.

The Fulmer patented control and "Stop and Dwell" system places all controls at "floor level" within easy reach of the operator, and permits honing open bores or up to internal shoulders or "blind" cylinders.

The Fulmer Honing Machine is the modern answer for low cost finishing of Diesel cylinders; piston valve, air pump and brake cylinders; reverse gear, stoker or other types of cylinders required in the railroad field. Remember—honing assures longer operating life of both the cylinder and packing.

FULMER PISTON RING LAPPER

Saves time and eliminates guesswork in fitting piston rings. The use of the Fulmer Piston Ring Lapper assures perfect contact of rings with cylinder walls, maximum control of lubrication and a great reduction in run-in time. Simple to operate, easily adjusted and flexible enough to handle any size cylinder within its range.



Write Today for Detailed Information

C. ALLEN FULMER COMPANY

1237 First National Bank Bldg., Cincinnati 2, Ohio

FULMER PRECISION SERVICE EQUIPMENT

DEALERS:
A few attractive territories remain open. Write today!

ROD BORERS • HONING MACHINES • RING LAPPERS • CENTRIFUGAL CASTING MACHINES

Why Speed Nuts are First

with Production Men

NOTHING LOCKS LIKE A SPEED NUT

Only SPEED NUTS provide a COMPENSATING thread lock and a SELF-ENERGIZING spring lock. As the screw is tightened the two arched prongs move inward to lock against the root of the screw thread. These free-acting prongs COMPENSATE for tolerance variations. Compression of the arch in prongs and base creates a SELF-ENERGIZING spring lock. These two forces combine to definitely prevent vibration loosening.

PRODUCTION men who actually use them really appreciate the ease with which SPEED NUTS are applied. They'll tell you that SPEED NUTS start easier, tighten down faster, and eliminate fumbling around with hard-to-handle lock washers.

Production men also will tell you how much time is saved by using any of the self-retaining types of SPEED NUTS. They merely snap these fasteners into bolt-receiving position by hand, instead of welding or riveting cage nuts in place. Moreover, these self-retaining SPEED NUTS provide "float" to compensate for misalignment of clearance holes.

These are only a few reasons why production men prefer SPEED NUTS. But reasons enough for you to investigate SPEED NUTS for your own benefit by writing today.

TINNERMAN PRODUCTS, INC. • 2029 Fulton Road, Cleveland 13, Ohio

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In France: Aerocessoires Simmonds, S. A., Paris
In England: Simmonds Aerocessories, Ltd., London
In Australia: Simmonds Aerocessories, Pty. Ltd., Melbourne

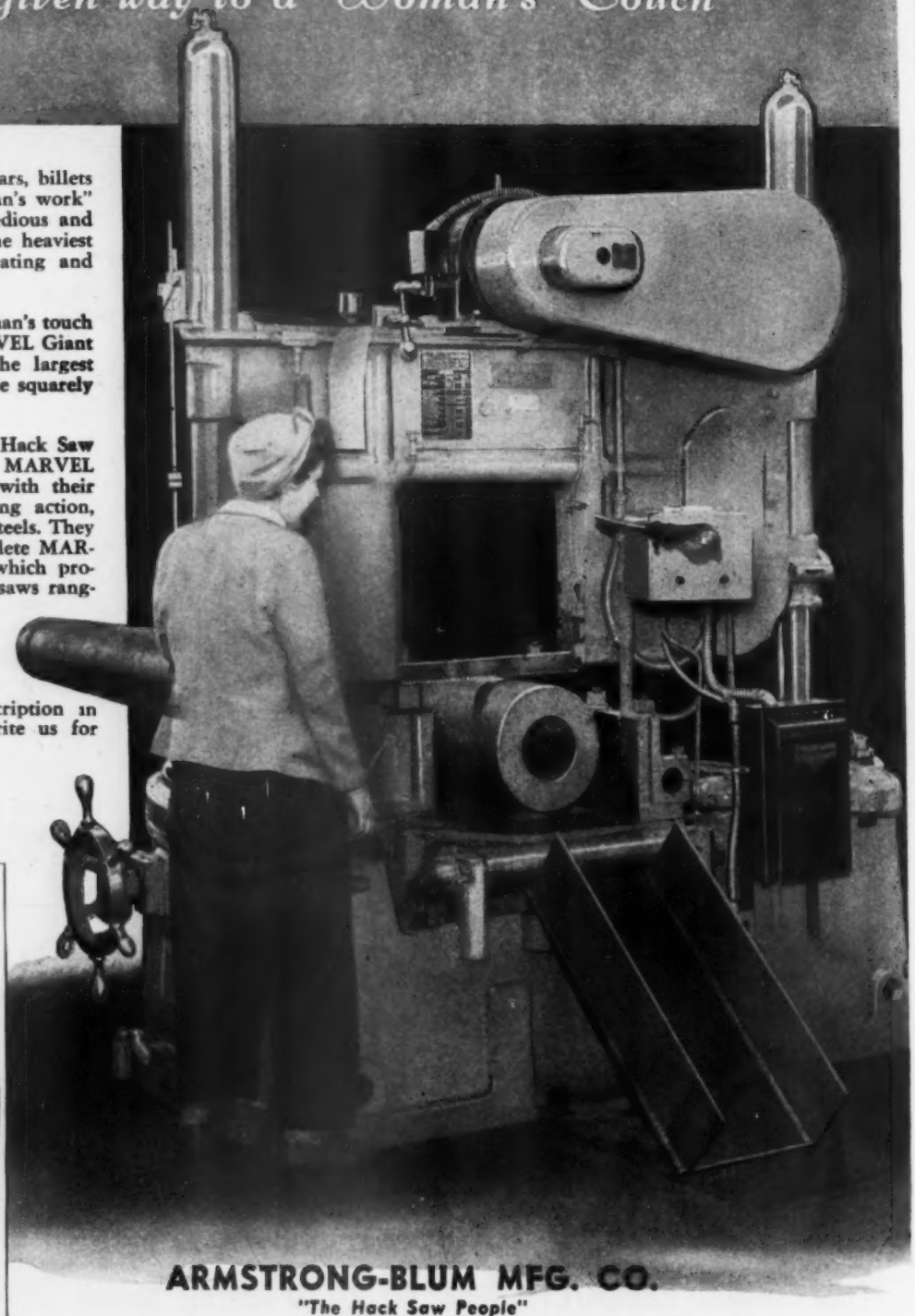
Speed Nuts* PATENTED

*Trade Mark Reg. U. S. Pat. Off.

FASTEST THING IN FASTENINGS...OVER 3000 SHAPES AND SIZES

THE SINEWS OF THE ARMORER

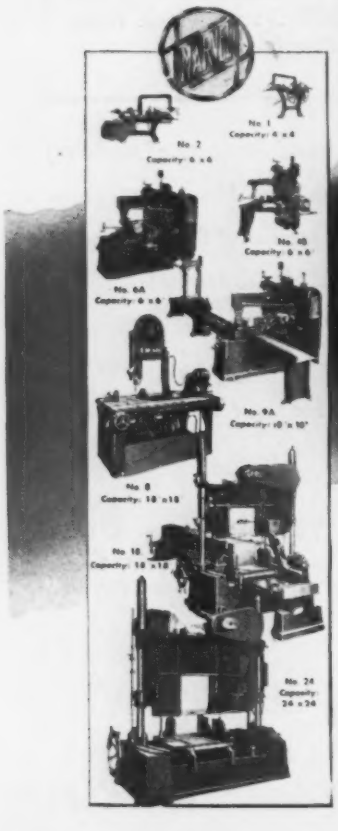
have given way to a Woman's Touch



The cutting-off of really large bars, billets or forgings has always been "man's work" —was a slow, costly series of tedious and laborious operations requiring the heaviest equipment, and a crew of sweating and straining handlers.

How different today when a woman's touch on the control button of a MARVEL Giant Hydraulic Hack Saw cuts off the largest pieces, and cuts each to exact size squarely and accurately.

The MARVEL Giant Hydraulic Hack Saw No. 18, capacity (18" x 18") and MARVEL No. 24, capacity (24" x 24") with their revolutionary "roll-stroke" cutting action, cut-off the toughest and hardest steels. They are the larger units in the complete MARVEL System of Metal Sawing, which provides 10 different types of hack saws ranging down to small economical dry-cutting shop saws. In the MARVEL SYSTEM you will find a saw exactly suited to your needs—in each case the best saw of its type. See full description in Sweet's Mechanical Files or write us for Catalog.



ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVE. CHICAGO 39, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York 12, N. Y.

MARVEL SAWS

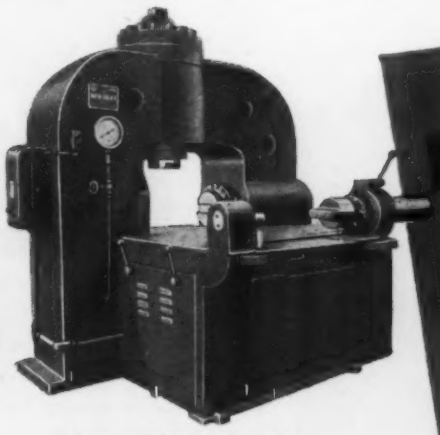
SPEED UP ASSEMBLY AND MAINTENANCE with W-S Hydraulic Shop Equipment

For fast, accurate assembly and maintenance jobs in railroad roundhouses and shops, Watson-Stillman hydraulic equipment answers today's demands, helps maintain uninterrupted traffic movement.

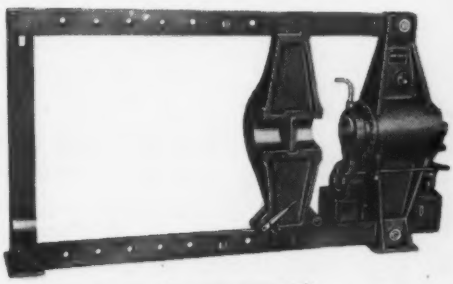
The power units and circuit designs built into W-S railroad equipment provide smooth, shockless press operation and pulsationless pressure application in forcing, driving, bushing, straightening, bending and lifting applications. Simplicity of their design and ruggedness of construction assures long, trouble-free service.

Portable and power-driven rail benders, bushing presses, wheel presses, crankpin and forcing presses, jacks, pit jacks and pulling jacks, spring shop equipment and Walter Stock adjusting machines are among the range of equipment available. These machines have been developed and perfected from a background of engineering and hydraulic experience acquired in serving railroad requirements for over 60 years. ***The Watson-Stillman Company, Roselle, New Jersey.***

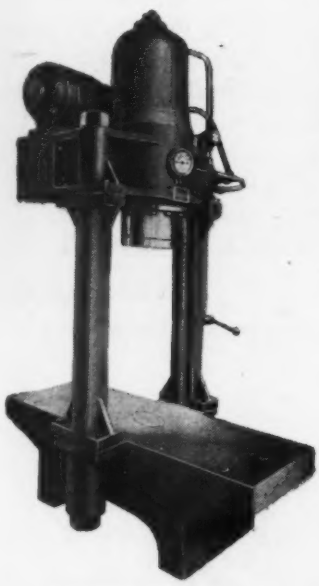
PIT JACKS
With telescopic and plain rams; air - driven or double - plunger hand pumps.



SPRING BANDING PRESS
Vertical moving-down ram and horizontal clamping ram; assembly table and auxiliary ram.



WHEEL PRESSES
Straight or Inclined. Completely hydraulic, full hydro-pneumatic, plain hydraulic, or hand powered.



BUSHING PRESSES
With plain or U-slotted pedestal type beds.

WALTER STOCK ADJUSTING MACHINE
For lengthening, straightening or shortening locomotive parts. Equipped with motor-driven pump.

SPRING STRIPPING MACHINE
100-ton capacity; self-contained oil pump and control.

POWER-DRIVEN RAIL BENDERS
100-ton capacity.

SPRING FORMING PRESS
Available for either hydraulic or pneumatic power.

CRANK PIN & FORCING PRESSES
With hand pumps, rack and pinion pullback; with air or motor-driven pump and hydraulic pullback.

PORTABLE RAIL BENDERS
Hook or hinged — Yoke types; for flat, "T", girder and guard rails.

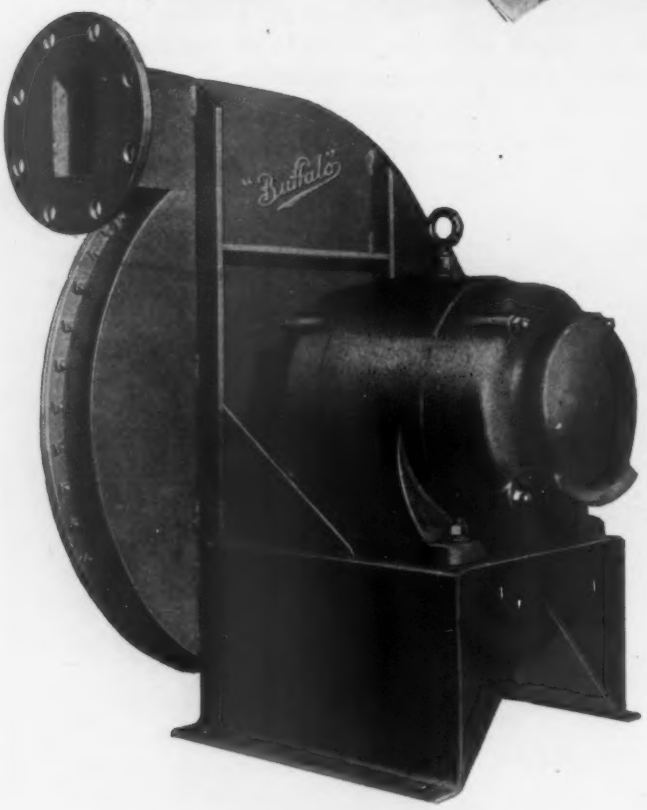
SPRING TESTING MACHINE
50-ton capacity; weight springs up to full working load.

PULLING JACKS
Adjustable, three-leg mounting; self-contained cylinder and pump.

WATSON-STILLMAN

Designers and manufacturers of hydraulic equipment, forged steel fittings and valves

ANOTHER MILESTONE *in Air Handling*



"Buffalo" HIGH PRESSURE BLOWERS

These new-type blowers were developed by Buffalo engineers to meet the needs of industrial applications where high air pressure is required at low to moderate air volumes. Their wide range of applications include the handling of air for oil or gas furnaces . . . on high pressure operations in glass, steel and chemical plants . . . for scale and water blow-off work . . . in experimental problems. Suitable for pressures up to 4 lbs. per square inch. Heavy welded steel plate construction without bulkiness; rigid, scientifically balanced rotors; economical to operate and maintain.

Engineering data in Bulletin 3553.

BUFFALO FORGE COMPANY

174 Mortimer Street **Buffalo, New York**

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" "First For Fans"

you wouldn't

lift a 500 pound load with a 100 pound capacity rope

It is just as foolish to put carbide cutting tools on an out-moded lathe. Carbide tools have increased horsepower requirements as much as 300 per cent.

Modern Jones & Lamson Lathes are designed specifically to carry this extra load, and more. They have the power, they have the rigidity, they are easy to operate.

Now is the time to check your equipment. Plan now to scrap obsolete machines and replace them with good War Surplus machines or new machines. Our engineers will be glad to assist you.

What HORSEPOWER Are You Using?

This cut, on 2-inch bar stock, requires 300 per cent more horsepower with a carbide tipped tool than with a high speed steel tool, and Carbide halves the cutting time.

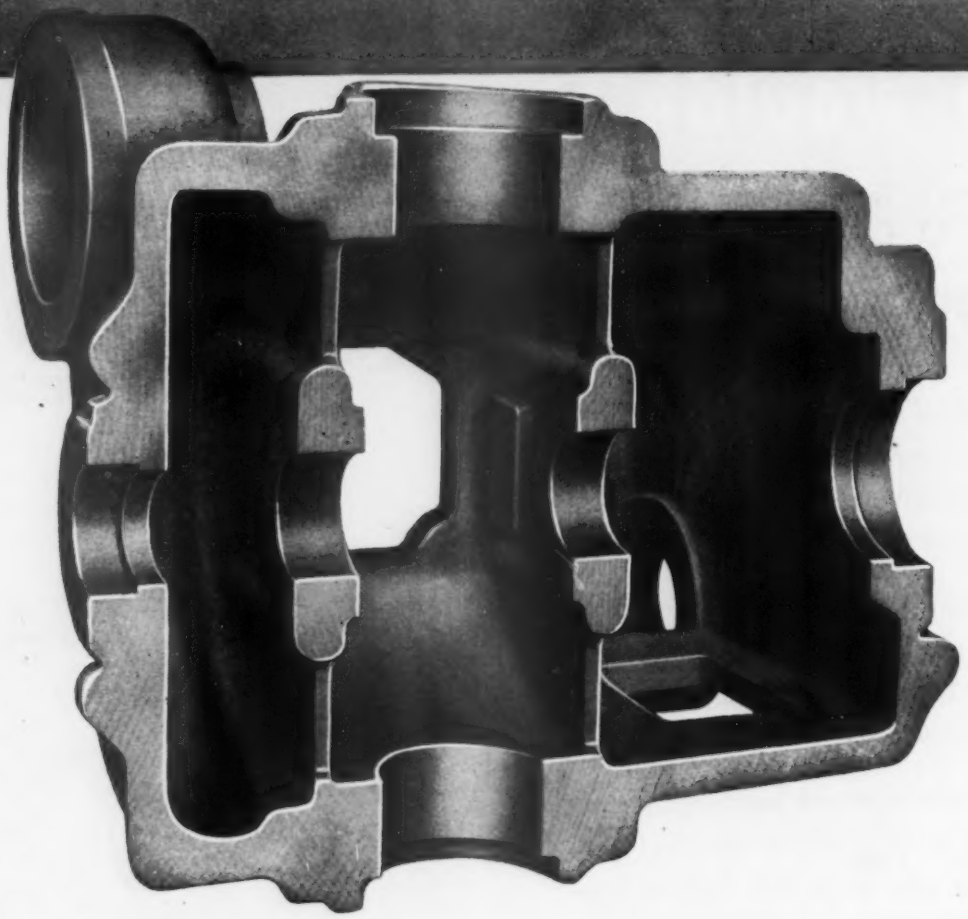
Engineered to "Carry the Load" for Most Productive Operation With Carbide Cutting Tools

JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S.A.

Turret Lathes

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

KNOW ANY FASTER WAY TO DO THIS JOB?



If you were given the job of facing the joint in this housing, how would you do it? It's cast iron, overall dimensions of surface—16¾" x 21¾". Stock to be removed 3/16".

Unless you knew a faster way, you'd tag this job for a Diamond Face Grinder because face grinding takes only 15 minutes floor-to-floor!

If you know of no faster way, look into the Diamond Face Grinder today. Write at once for Bulletin 44-G.

MAIL TODAY FOR NEW FOLDER

Diamond Machine Company of Philadelphia
2510 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Please send me promptly your Bulletin 44-G which shows how to speed-up production with the Diamond Face Grinder.

Name_____ Title_____

Company_____

Address_____ State_____

City_____

"THE DIAMOND D THAT CUTS YOUR COSTS"

DIAMOND
MACHINE COMPANY
OF PHILADELPHIA

LONG LIFE!

1.

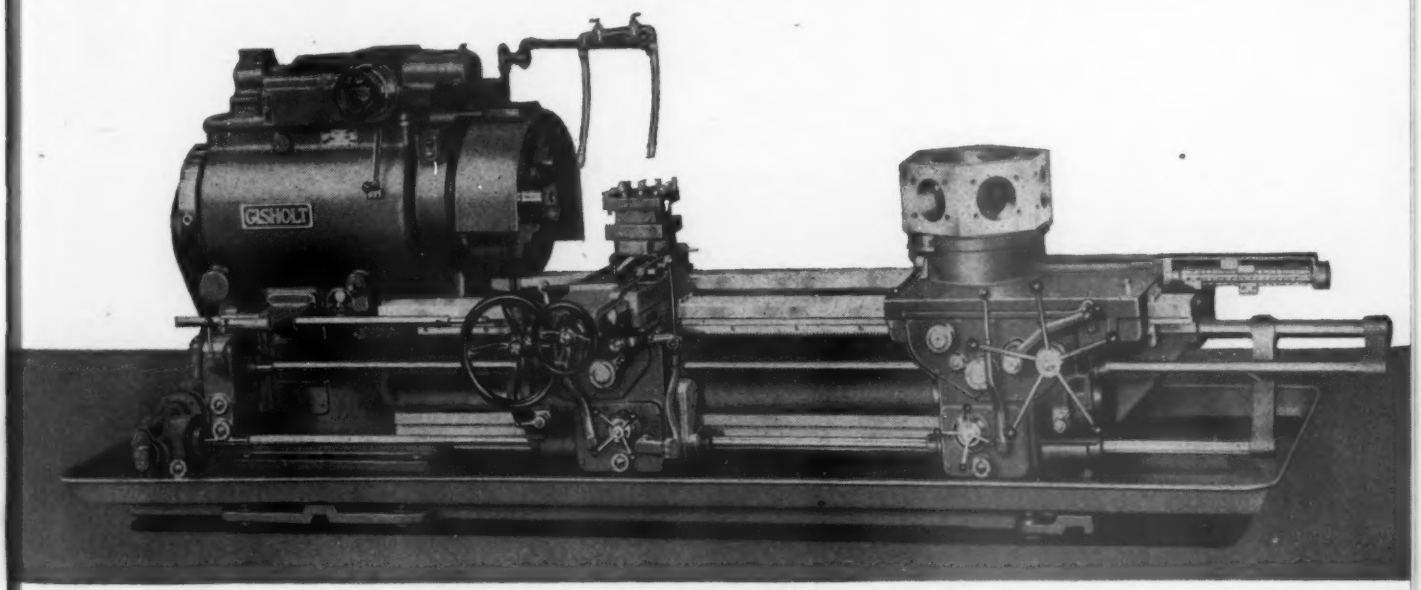
All gears in Gisholt's 12-speed transmission are high carbon alloy steel, precision ground after heat-treatment to assure long wearing quality. All shafts turn on antifriction bearings, with pressure spray lubrication. Headstock is cast integral with bed for extreme rigidity—to maintain accurate, permanent alignment.

2.

Gisholt's thick, block-type ways are automatically pressure lubricated. Made of SAE 52100 tool steel, they are deep hardened to 64-66 on the Rockwell C Scale and finish-ground in exact alignment with the spindle. On top, bottom and both sides, they present a bearing surface that is virtually wear-proof—assuring accuracy for years to come.

3.

Aprons are fully enclosed, all working parts protected and operating in a continuous cascade oil bath. Alloy steel gears and shafts are mounted on antifriction bearings. Positive serrated feed and traverse clutches cannot slip or bind. Safety shear pins protect feed and traverse mechanism against overload and accident.



● You want speed and easy operation in a turret lathe, of course. And you'll find them in these Gisholts. But you want long life, too, when you invest in a turret lathe. It means lasting accuracy, freedom from repair bills, protection for your investment for years to come. Ask for full information.

GISHOLT MACHINE COMPANY • *1293 E. Washington Ave., Madison 3, Wis.*

Look Ahead... Keep Ahead... With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

AMERICAN
FOR
ALL OUT
PRODUCTION

MIGHTY LATHES *Turn* MIGHTY SHAFTS *for* THE U.S. NAVY

"AMERICAN" 48" Lathes, both in Navy Yards and Contractors' Plants, are adding their enormous power and productive capacity to the building of our "two-ocean" Navy.

True, work like this is not encountered in railroad shops, but when the power, stamina and operating ease of "AMERICAN" Lathes are turned to railroad shop operations, production costs are bound to tumble.

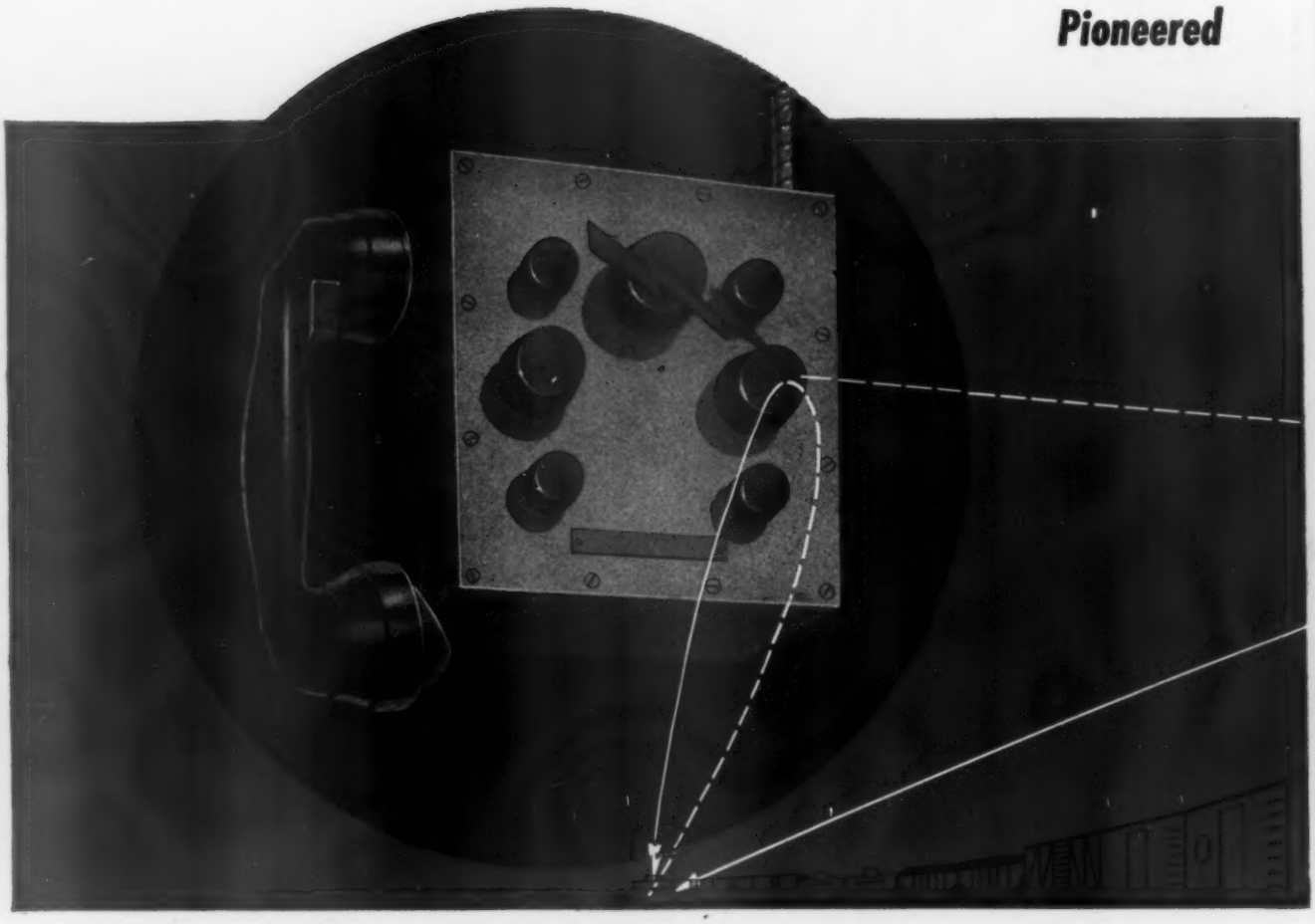
THE AMERICAN TOOL WORKS COMPANY

Lathes and Radial Drills

CINCINNATI, OHIO, U. S. A.

Train Radio

Pioneered



Westinghouse again proves its leadership in the field of Railroad Electrical Equipment . . . with the development of "Train Radio", designed and built *specifically for railroads*.

First installed by Westinghouse in 1925 on an eastern railroad, and more recently used in successful experimental installations on the New Haven Railroad . . . this new important transportation development speeds routing . . . dispatching, and assists in the direction of repair and maintenance work . . . helps crew co-ordination . . . simplifies inspection.

The Westinghouse Train Radio permits instant, clear, three-way conversation . . . wayside station to train . . . train to train . . . engineer to caboose.

WESTINGHOUSE

FOR OVER 60 YEARS THE BEST KNOWN NAME

by Westinghouse

Westinghouse . . . Radio Firsts

- ***FIRST*** to install Train Radio . . . in 1925 on an eastern railroad.
- ***FIRST*** to originate short wave broadcast in 1922 by 8XK Pittsburgh.
- ***FIRST*** to build a remote pickup station in 1924.
- ***FIRST*** to apply for patent on cathode ray tube for television—November 16, 1929.

• • •

For application of Westinghouse Train Radio to your communication system . . . contact your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-95111

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

IN RAILROAD ELECTRICAL EQUIPMENT

simultaneous ROUGH and FINISH MACHINING at 3500 to 4000 surface feet per minute

G. & L. Makes Both Intermittent and Continuous Cuts on Tough Aluminum Alloy Castings in Single Pass of Work...Using One or Two Tool Bits for Dual Operation

It was necessary to devise an entirely new machining method to finish these special alloy aluminum castings. Conventional cutters and customary feeds and speeds used on several different machine tools would not produce parts to meet the following rigid requirements:

Surface flatness
Surface finish
Surface alignment

A G. & L. Horizontal Boring, Drilling and Milling Machine equipped with single point tungsten carbide cutters properly ground and mounted in simple tool holders produced parts to meet the above specifications. In addition, the castings were completed in less time and at less cost.

TOOLING FACTS

Single point and two-lipped fly cutters are substituted for ordinary milling cutters, end mills, and face mills. Tool holders are made in sizes up to 30" in diameter from mild steel discs to give greater cutting speed and to cover the entire work surface of the piece.

Either one or two carbide tipped tools are mounted on the plate. Cutters work equally well roughing and finishing, and on *continuous or intermittent cuts even to a depth of 3/8" at a surface speed of 3500 to 4000 feet per minute.* Horizontal boring machine rapid traverse is often used to obtain sufficient feed for this work.

Then to obtain a fine finish on narrow parts where a slightly concave surface is not objectionable, the single point tool is tilted slightly in the holder to permit the heel of the cutter to drag. Here the single tool acts both as a rougher and finisher.

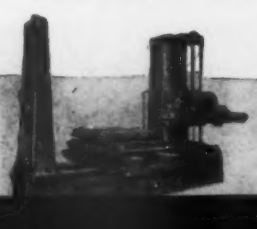
A large positive rake angle ground on the cutters helps to reduce the cutting pressure on the work. This proves important when thin and frail parts are machined. A negative back rake of 25-30° and a side rake of 15° is nearly always used.

ADAPTABILITY OF G. & L. MACHINES

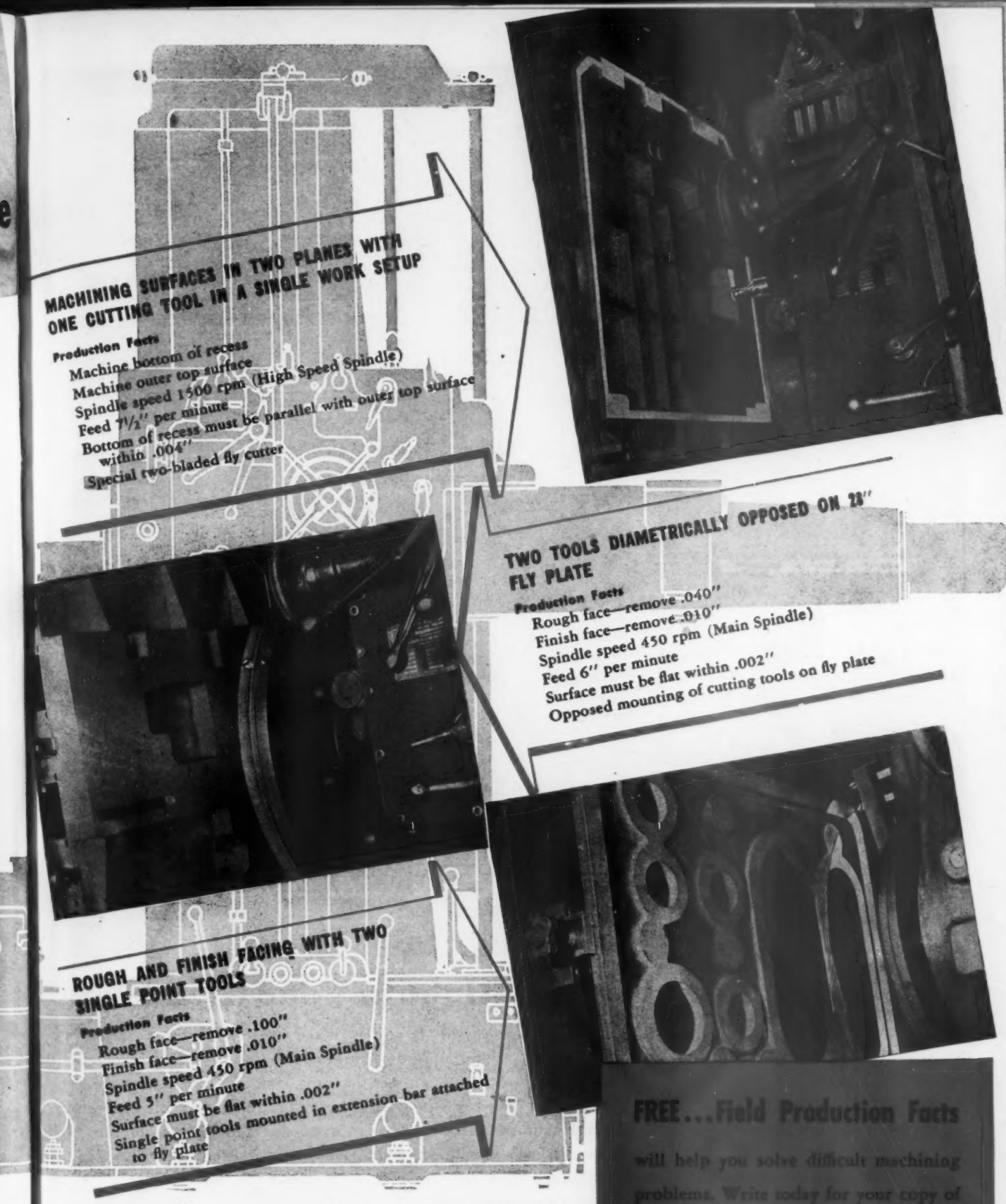
This is another example showing how G. & L.'s are meeting difficult machining requirements through versatility of operation. In this case, work ordinarily routed over several individual machines is handled more easily and in less time on a Giddings & Lewis Horizontal Boring Machine. G. & L. engineers will gladly recommend complete machining methods and tooling requirements for your particular needs.

GIDDINGS & LEWIS
150 DOTY STREET

Right: G. & L. Table Type Machine.



Right: G. & L. Floor Type Machine.



MACHINING SURFACES IN TWO PLANES WITH ONE CUTTING TOOL IN A SINGLE WORK SETUP

Production Facts
Machine bottom of recess
Machine outer top surface
Spindle speed 1500 rpm (High Speed Spindle)
Feed 7½" per minute
Bottom of recess must be parallel with outer top surface within .004"
Special two-bladed fly cutter

TWO TOOLS DIAMETRICALLY OPPOSED ON 28" FLY PLATE

Production Facts
Rough face—remove .040"
Finish face—remove .010"
Spindle speed 450 rpm (Main Spindle)
Feed 6" per minute
Surface must be flat within .002"
Opposed mounting of cutting tools on fly plate

ROUGH AND FINISH FACING WITH TWO SINGLE POINT TOOLS

Production Facts
Rough face—remove .100"
Finish face—remove .010"
Spindle speed 450 rpm (Main Spindle)
Feed 5" per minute
Surface must be flat within .002"
Single point tools mounted in extension bar attached to fly plate

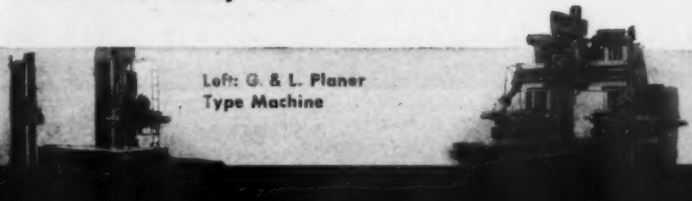
Photographs Courtesy General Mills, Inc., Mechanical Division, Minneapolis, Minnesota.

MACHINE TOOL CO.

FOND DU LAC, WIS.

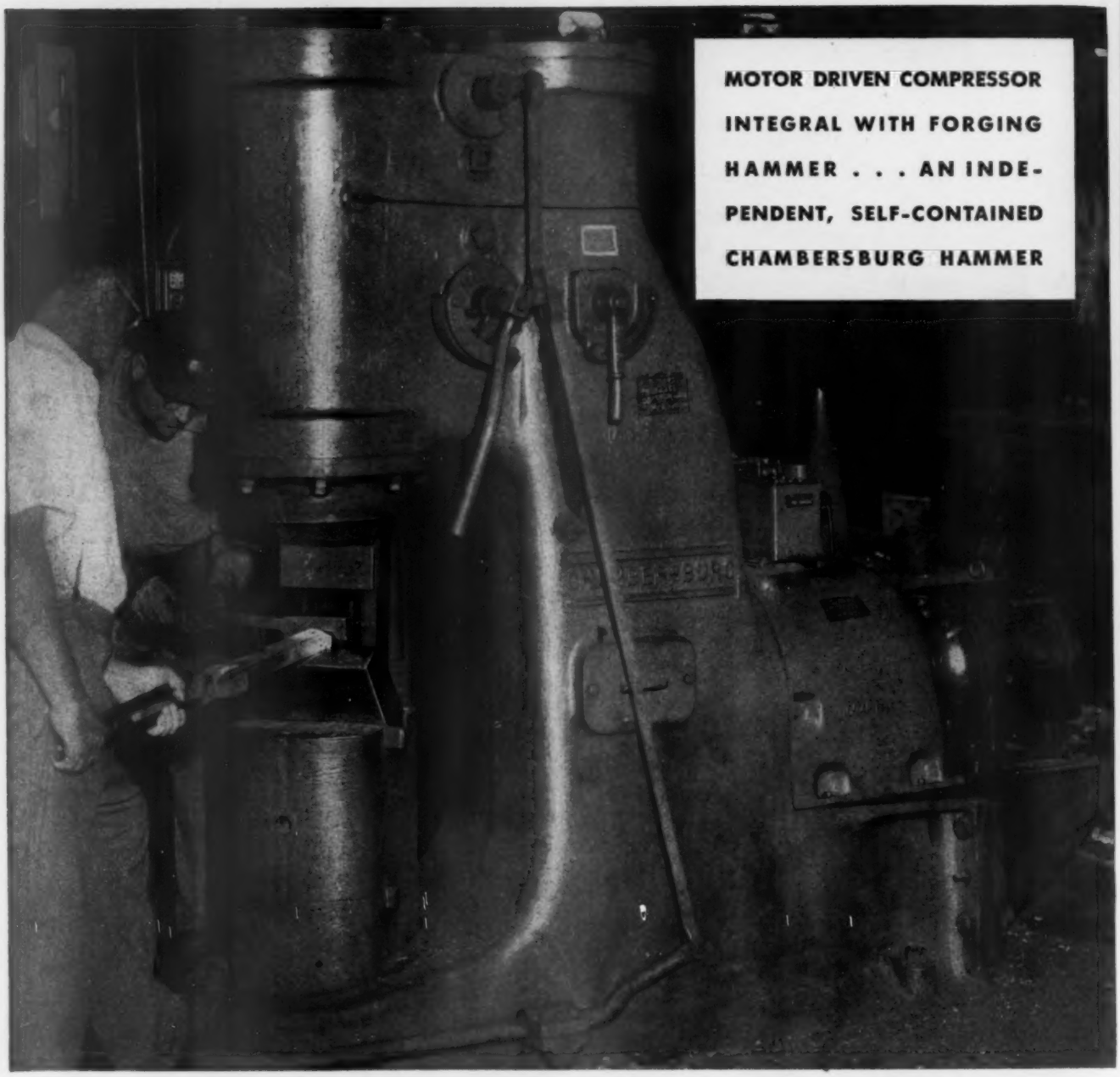
FREE...Field Production Facts

will help you solve difficult machining problems. Write today for your copy of Trade Journal Advertising covering advanced G. & L. machining methods. Please indicate your business connection.



Left: G. & L. Planer Type Machine

Left: G. & L. Multiple Head Type Machine



Now You Can Do Forging Right in Your Own Plant

Independent of steam or air lines, the Chambersburg Pneumatic Hammer may be placed wherever convenient in the plant. It is ready to operate as soon as the motor is up to speed, delivering its constant rhythm of blows, heavy or light, at the will of the operator. It will forge faster . . . better . . . at a higher temperature . . . because of higher impact speeds, heavier anvil construction and more powerful blows. It was designed with just that objective in view—to make *better* forgings faster, to work the forging at higher temperatures and to produce the forging with the least possible operating expense. The success of this objective is attested by the increasing popularity of this hammer.

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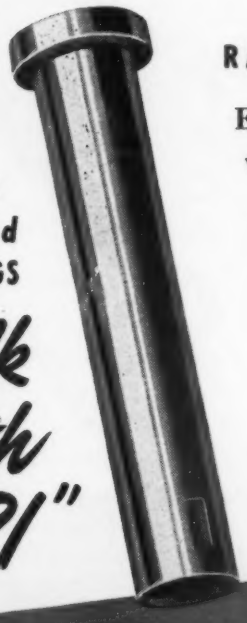

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AERONAUTICAL PRODUCTS, Inc.

Plant and General Offices: Washington Court House, Ohio

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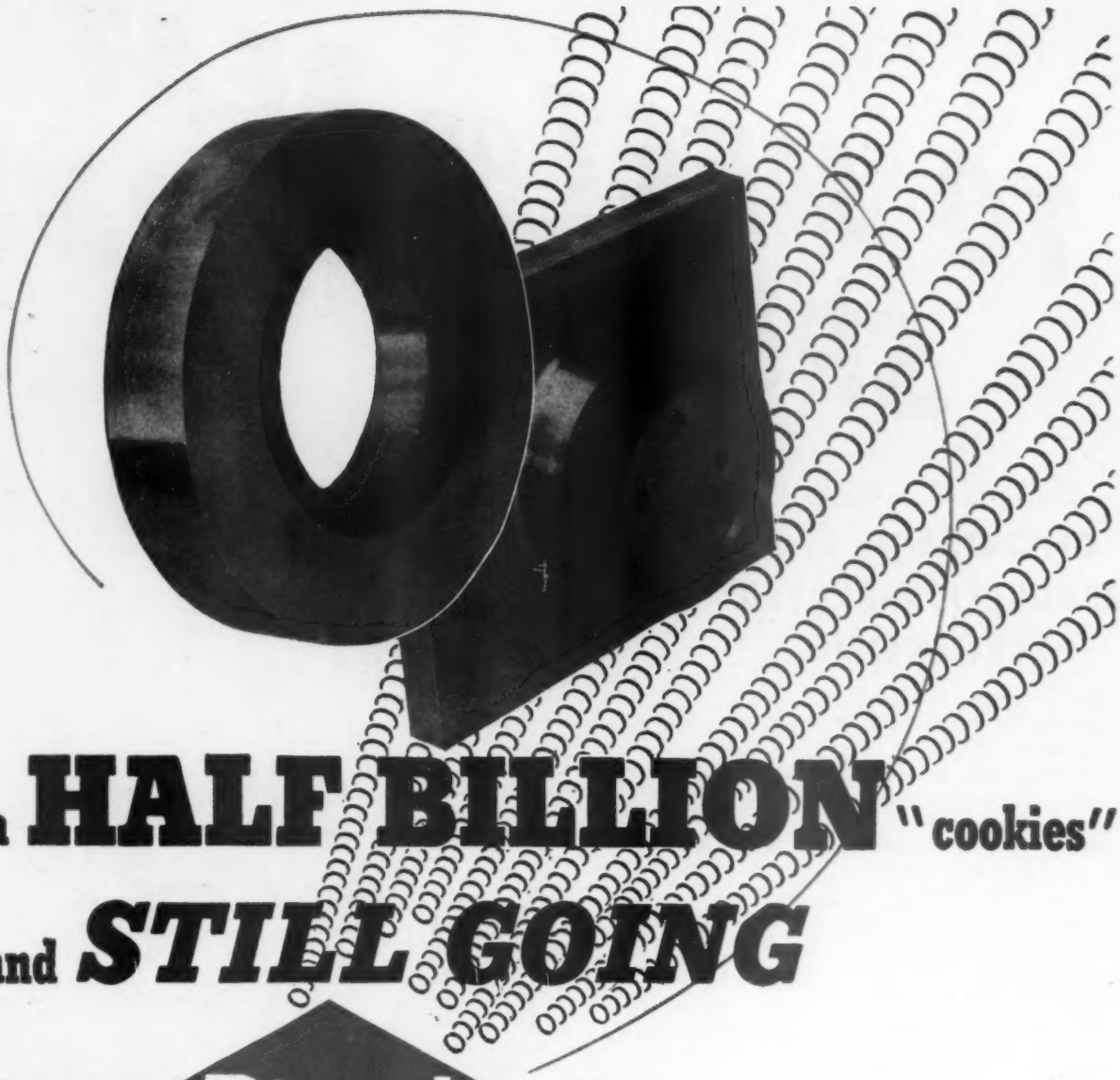
Reduce set-up time

Machine tools make money only when producing. Set-up time is non-productive, but it can be minimized by having *enough* of the *proper* wrenches at hand when setting-up.

Williams "Superior" Carbon Steel Wrenches—made in 50 patterns, over 1000 sizes—have been industry's standby for more than half a century. Forged from specially-processed carbon steel, they average 93% as strong as corresponding alloy wrenches costing almost twice as much. Sold by Industrial Distributors everywhere.

J. H. WILLIAMS & CO., BUFFALO 7, NEW YORK



over a HALF BILLION "cookies" .... and STILL GOING

with these Diecarb dies

SEVERAL years ago, in a Pittsburgh electrical manufacturing plant, a disc or "cookie" die was placed in operation. It was made of Diecarb, Firth-Sterling's newest, original, sintered carbide development for blanking dies. This "cookie" die blanked a circle of silicon electrical sheet .025 inch thick, to be used in rotors and stators.

It proved so successful that since then two other similar Diecarb dies have been put to work—all averaging *50 to 60 million* blanks per grind, as compared with 90,000 pieces per grind with high speed steel dies.

The original die, at the latest count, had produced the unprecedented total of over a half billion stampings, and was still going!

In fact, the life of these remarkable Diecarb dies is not yet determined because all dies so far made are still in use.

Diecarb can be used for blanking and forming a diversity of materials including metals, plastics, paper, etc. It operates successfully on thicknesses up to 7/16 inch. It is proving unmatchable for high production operations, saving both downtime and maintenance.

If you have a product that requires blanking or if you are planning one—call in Firth-Sterling now to test the possibilities of Diecarb.

GET IN TOUCH WITH US

A complete Diecarb engineering service is at your call—for designing complete dies; for aiding in application of Diecarb to die shoes by brazing; shrink-fitting; press fitting and mechanical matrix; and for proper grinding.

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TO MEET OR BEAT SPECIFICATIONS

CHOOSE A G-E *PRODUCTION-PROVED* ELECTRODE

Before it is classified and made available for general use, every new G-E electrode undergoes exhaustive laboratory tests under a wide range of conditions. Specification requirements must be met or exceeded.

Next, it must meet the tough, wartime demands of actual production in G-E plants. If it meets specifications under these severe production conditions, with an ample margin, it is then, and only then, placed upon the market.

The G-E electrodes illustrated here have been thoroughly production-proved. They will produce a weld of superior quality and excellent profile and surface appearance, when used in designed positions and types of work.

Production data, for each type and size of G-E electrode, is printed right on the carton. You'll find it easy to estimate weld-footage per pound for typical joints.

Ask for Samples

If there are G-E electrodes you haven't used, but would like to test on your own work, get in touch with your G-E arc-welding distributor, or the nearest G-E office, for full details and samples. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

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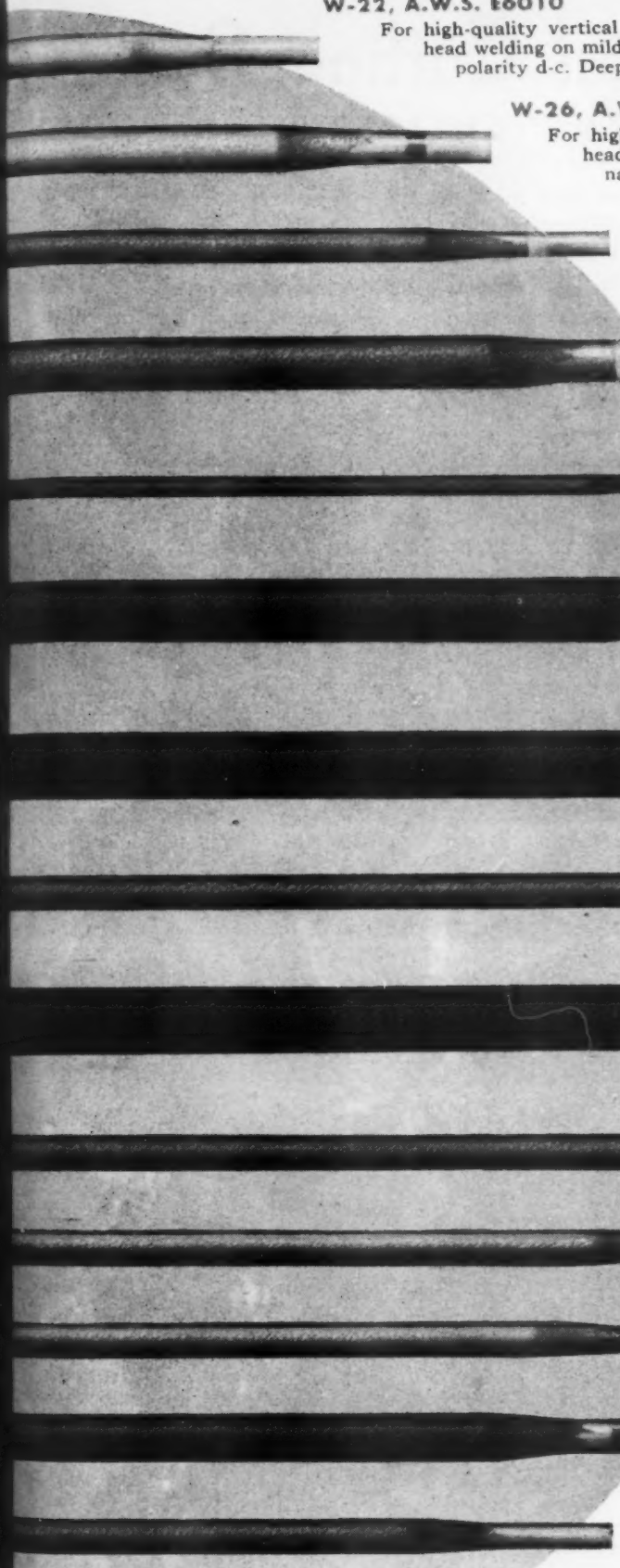
Company
GENERAL ELECTRIC
ARC WELDING
ELECTRODES
TYPE W-56
SIZE 5/32" X 14"
SCHENECTADY, N. Y.
PRODUCTION DATA
This 50 lb. box of electrodes will produce 29.2 lb. of filler metal in joint, based on 2" stub ends.
Welding production is estimated as follows:
234 linear ft of 1/4" vertical fillet welds
150 linear ft of 5/16" vertical fillet welds
104 linear ft of 3/8" vertical fillet welds
These electrodes will meet AWS specifications Class E-7010 and E-7011
MADE IN U.S.A.

ARC-WELDING ELECTRODES



W-22, A.W.S. E6010

For high-quality vertical and overhead welding on mild steel with rev-polarity d-c. Deep penetration.

W-26, A.W.S. E6011

For high-quality vertical and overhead welding on mild steel with alternating current. Deep penetration.

W-20, A.W.S. E6012

For general all-position welding on mild steel with a-c or straight-polarity d-c. Good for poor-fit-up work. Medium penetration.

W-30, A.W.S. E6012

For high-speed welding on mild steel with a-c or straight-polarity d-c. Medium penetration.

W-25, A.W.S. E6013

For welding light-gage mild steel in any position with a-c or straight-polarity d-c. Light penetration.

W-24, A.W.S. E6020

For welding horizontal fillets and flat joints on mild steel with a-c or straight polarity d-c. Approved for both conventional and deep-fillet techniques. Deep penetration.

W-27, A.W.S. E6020

For horizontal fillet welds and joints of all types in the flat position using a-c or d-c. Deep penetration.

W-52, A.W.S. E7010

For high-quality vertical and overhead welding on low-alloy, high-tensile steel with reverse-polarity d-c. Deep penetration.

W-54, A.W.S. E7020

For welding horizontal fillets and flat joints on low-alloy, high-tensile steel with a-c or straight-polarity d-c. Deep penetration.

W-55

For all-position welding of SAE 4130 and low-alloy, high-tensile steels using a-c or straight-polarity d-c. Medium penetration.

W-56, A.W.S. E7011

For high-quality vertical and overhead welding of low-alloy, high-tensile steels using a-c or reverse-polarity d-c. Deep penetration.

W-58, A.W.S. E8011

For high-quality welding of chrome moly steel, in all positions, using a-c or reverse-polarity d-c. Deep pen.

W-93

For building up wear-resisting surfaces using a-c or reverse-polarity d-c. Medium penetration.

W-83

For welding cast iron in any position with reverse-polarity d-c or with a-c. Medium penetration.

NOTE: Tear this page out and fasten to wall for a ready-reference chart.

GENERAL ELECTRIC

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A Complete Metal Cutting System
FOR RAILWAY SHOPS

"O K" means a *system* — a variety of inserted-blade metal cutting tools wide enough to meet the major needs of any railway shop. Milling, reaming, boring, planing, can all be speeded up and the work usually improved by their consistent use. O K Tools are now available. You can outfit an entire department, or you can "sample" their efficiency by "peaking" up some one run. Your own *actual experience* will soon demonstrate why they are so generally favored in railway shops. Glad to make constructive suggestions if you will describe the kind of work you wish to improve.

In O K Milling Cutters and Single-Point Tools, the blades or bits are separate cutting units, the bodies are of drop-forged alloy steel. In the milling cutters, and in the single-point tools, the blades or bits are held in mating serrations or in other secure locking devices — always easily adjustable in line of wear, simple to renew. Made in a wide variety of styles and sizes for all types of metal cutting machines.

FREE BOOKLET ON GRINDING MILLING CUTTERS

Contains very useful data on grinding, adjusting, reblading, clearances, etc. Profusely illustrated, clearly worded. Convenient file and pocket size. Glad to send it without charge to any interested shop man.

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Originators of the inserted-blade principle

THE TRADE O K MARK SYSTEM
OF INSERTED-BLADE METAL CUTTING TOOLS

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There's a SHOUT of PROPHECY in these FIRST PICTURES of Bear Dy-Namic Balancing in the Burnside Shops of The Illinois Central Railroad
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The dream of the scientist and engineer is now coming into fulfilment on the railroad. Evident and proven is the desirability of Dy-Namically Balancing everything that revolves in order to increase its life and efficiency and reduce maintenance time and expense. Now, with the development of the simpler, faster, lower cost Bear Dy-Namic Balancing Technique, it is eminently practical to dy-namically balance every rotating part on the railroad from armatures to car and engine wheels! Your inquiry will be most cordially welcomed. Write Will Dammann, President, Bear Mfg. Co., Rock Island, Illinois.
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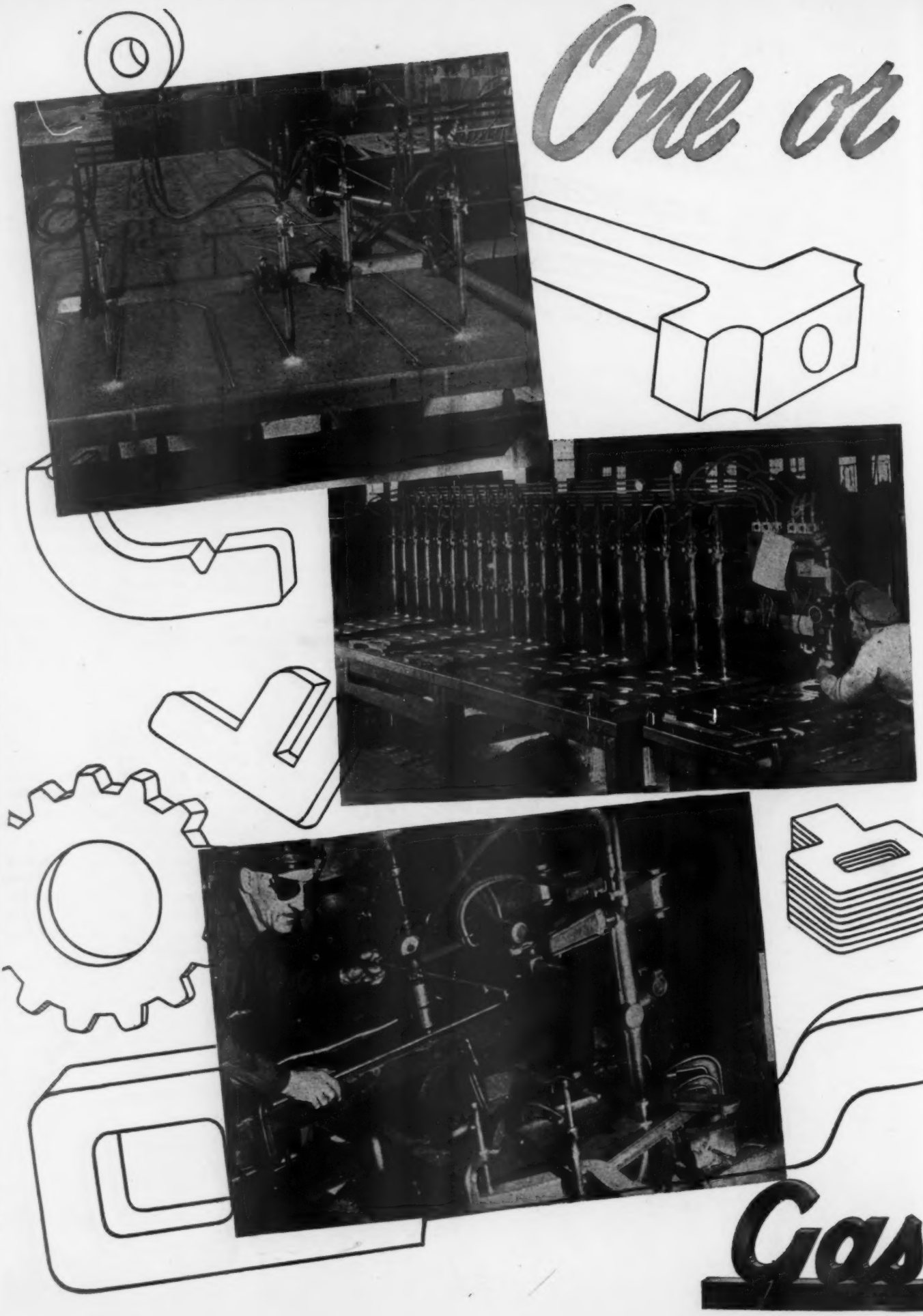

One or
Gas

One Million

You Can Flame Cut Accurate Steel Parts of Any Contour, and of Practically Any Size, Faster and More Economically with the Proper Airco Gas Cutting Machine

As pioneer designers of flame cutting machines, Airco has been and continues to be in the forefront in the development and application of these machines.

To enable manufacturers to take advantage of the opportunities for economy and product improvement which flame cutting offers, Airco has perfected three pantograph type cutting machines which, by reason of their range and flexibility, meet practically every requirement for parts production by this process.

The Planograph is mounted on a carriage which travels on the tracing table. Maximum cutting range with single torch is 24" wide by 72" long, and maximum diameter for circle cutting is 24".

The Oxygraph is one of the most popular shape cutting machines ever offered. It is designed for single or multiple torch operation.

The Travograph is a machine having the basic design of the Oxygraph, but mounted on a carriage which travels on steel rails. Maximum cutting widths are 6', 10' and 12', depending upon the model of machine used. The cutting length is limited only by the length of rails installed. These machines also are designed for single or multiple torch operation.

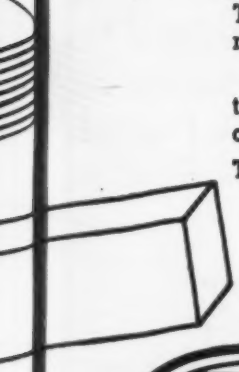
To afford greatest flexibility, three types of tracing devices are available — all quickly interchangeable on each type of machine.

The Manual Tracing Device is hand guided by the operator, following a full size drawing or layout of the part. It can also be locked to travel in straight lines in any direction, saving time when cutting irregular shapes involving considerable straight-line cutting. The manual tracing device is designed primarily for use where a small number of parts is to be cut.

The Magnetic Tracing Device makes the operation of the machine practically fully automatic. The magnetic force holds the rotating roller against a steel cam or template of the design to be cut, assuring positive traction and close adherence to the contour of the template. It is especially recommended for use in producing parts in large numbers and its use frees the operator for other work during a good part of the cutting operation.

The Spindle Tracing Device has a power-driven spindle which the operator holds against a template of plywood or similar material shaped to the design to be reproduced. This contact affords the necessary traction to move the tracer around the contour of the template. It is designed for use where the number of parts to be cut justifies the cost of making the template.

• **Folders describing these gas cutting machines in fuller detail may be obtained from the nearest Airco office or from Dept. RM, Air Reduction, General Offices: 60 East 42nd Street, New York 17, N. Y. In Texas, Magnolia Airco Gas Products Co., General Offices: Houston 1, Texas.**



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Like the Wall of China, Penciltex is a symbol of permanence. After many years of reference, filing and printing, pencil drawings on Penciltex continue to make good prints. Penciltex has proven its claim to provide permanent engineering records without sacrificing the drawing speed of pencil. Penciltex is another successful Post idea to provide better drafting room methods. Penciltex is made only by Post.

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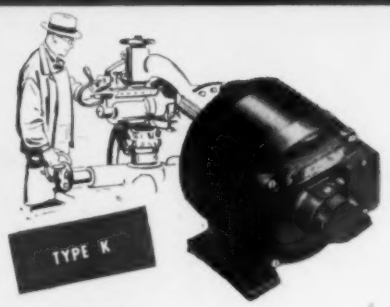
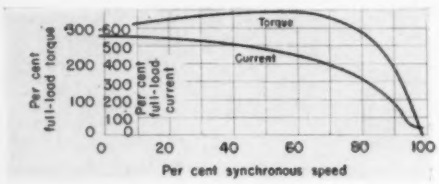


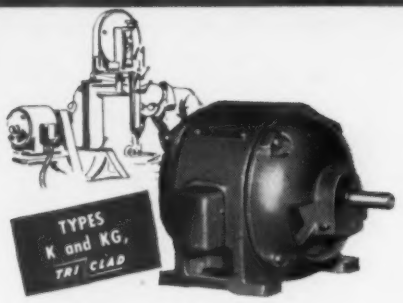
FRACTIONAL-HP

For machine tools requiring constant speed, frequent start-stop service, plugging duty, or where metal-dust atmospheres are encountered.



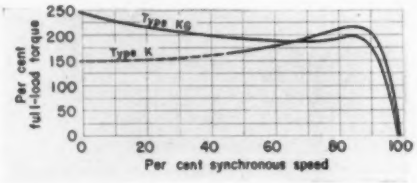
1/6 to 1 hp at 1725 rpm
110, 208, 220/440, 550 volts
1725 rpm at 60 cycles
Constant speed, high torque
Sleeve or ball bearings
Open or enclosed

Write for Bulletin GEA-1974



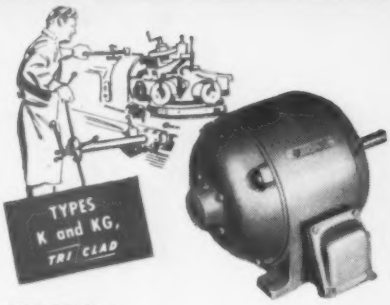
OPEN AND DRIPPROOF

For fans, pumps, saws, lathes, etc., where constant speed and "snappy" starting ability are required. Its low starting current permits use of economical controls.



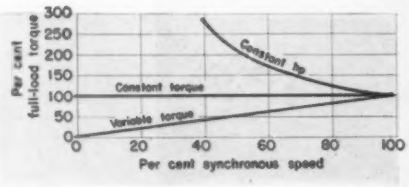
1/4 to several thousand hp
100, 208, 220/440, 550 volts
450 to 3600 rpm
Constant speed, high or normal torque
Sleeve or ball bearings

Write for Bulletin GEA-3580



MULTISPEED

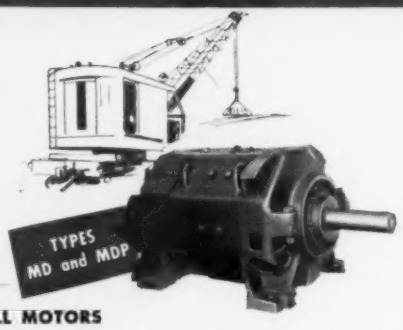
For machine tool, and other applications requiring two to four definite speeds.



1 to 200 hp at 1800 rpm
100, 208, 440, 550, 2200 volts
600 to 3600 rpm at 60 cycles
Ball bearings
Constant speed and variable torque

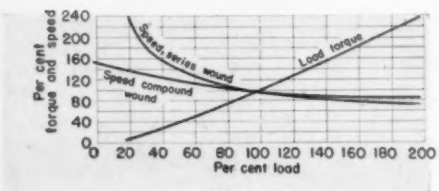
Write for Bulletin GEA-1884

A-C POLYPHASE



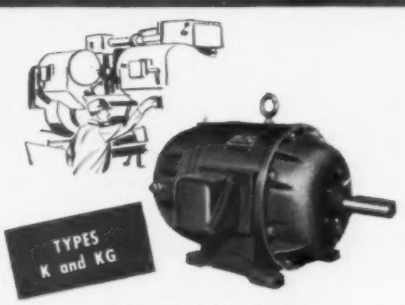
MILL MOTORS

For extra-heavy-duty applications such as cranes, hoists, lift bridges, and electric shovels. For use where 75 C temperature rating is wanted.



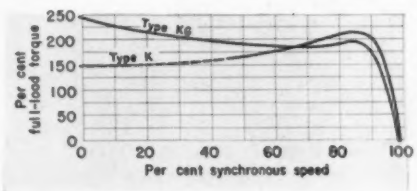
6½ to 660 hp
230, 550 volts
750 to 324 rpm
Constant speed, shunt and compound wound
Varying speed, series wound

Write for Bulletin GEA-714



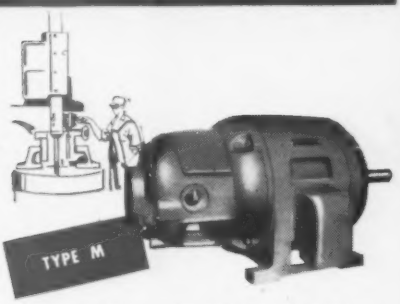
TOTALLY ENCLOSED, FAN-COOLED

For applications where extreme-moisture conditions, abrasive or conductive dusts, and/or alkali fumes exist. For outdoor applications where regular attention is not possible.



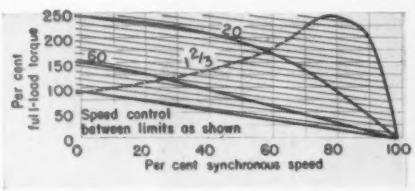
½ to 1000 hp
110, 208, 220, 440, 550 volts
450 to 3600 rpm
Constant speed, high, or normal torque
Ball bearings
Also available not fan cooled

Write for Bulletin GEA-1326



WOUND-ROTOR, GENERAL-PURPOSE

For constant-speed applications requiring frequent starting or reversing under heavy load, or where exceptional starting duty is required, such as: pumps, blowers, compressors, etc.



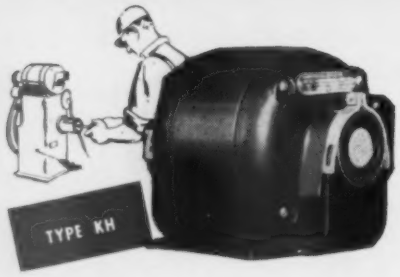
1 to several thousand hp at 1800 rpm
100, 208, 220, 440, 550 volts
Constant or adjustable-varying speed
Ball bearings
High starting torque, low starting current

Write for Bulletin GEA-1698

GENERAL ELECTRIC

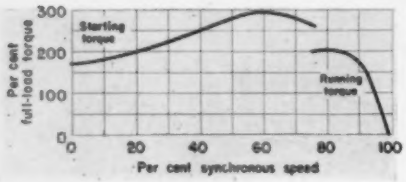
POPULAR G-E MOTORS

A-C SINGLE-PHASE



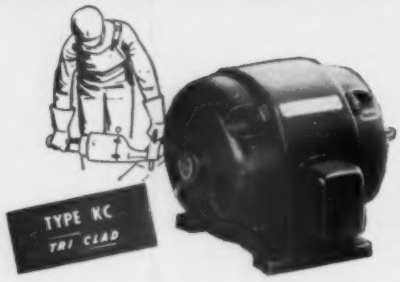
FRACTIONAL-HP

For small machine tools, paint spraying compressors, fans, blowers, etc., where high starting torque is not required.



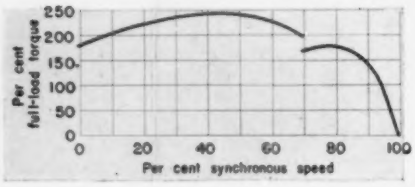
1/20 to 1/2 hp at 1800 rpm
115, 230 volts
900 to 3600 rpm at 60 cycles
Sleeve or ball bearings
Enclosed, dripproof, or open enclosure
Constant speed, moderate torque

Write for Bulletin GEA-1276



GENERAL-PURPOSE, CAPACITOR

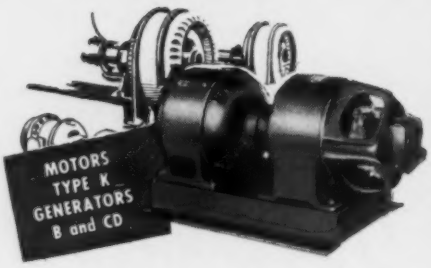
For direct-connected and belt-driven fans and blowers, centrifugal pumps, and other applications requiring moderate starting torque and quiet operation.



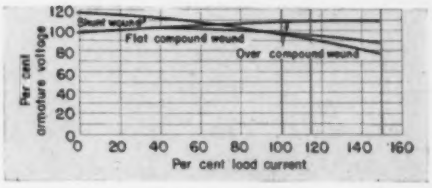
½ to 5 hp at 1800 rpm
115/230, 230 volts
900 to 3600 rpm at 60 cycles
Sleeve or ball bearings
Open or dripproof enclosure
Constant speed, moderate starting torque

Write for Bulletin GEA-3603

INDUCTION M-G SETS



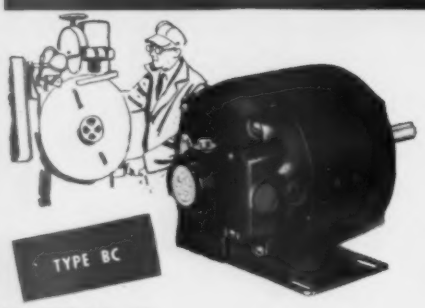
For driving direct current motors on machine tools, cranes, hoists, etc. Also used as a source of excitation for alternators, synchronous motors, and large d-c motors and generators.



3/4 to 150 kw, d-c voltage 125–250
110 to 220 volts
1200 and 1800 rpm at 60 cycles
3- or 2-phase induction motor
Shunt- or compound-wound d-c generator
3-bearing, 40C, continuous rated

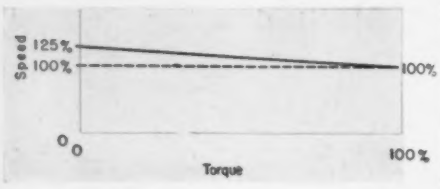
Write for Bulletin GEA-394

D-C



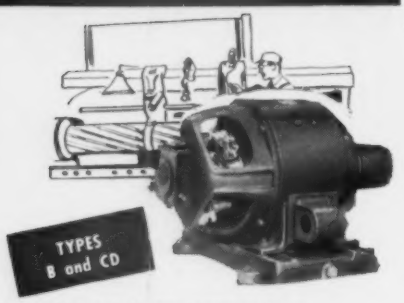
FRACTIONAL-HP

For general-purpose, constant-speed applications. Bearings require infrequent lubrication; frames protect against falling dirt and water. Internally mounted filter capacitor suppresses radio interference.



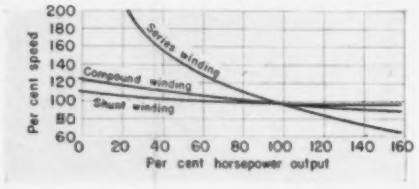
1/6 to 1 hp at 1725 rpm
115, 230 volts
860 to 3450 rpm
Sleeve or ball bearings
Enclosed, open, or dripproof enclosure
Constant speed, adjustable-starting torque

Write for Bulletin GEA-3515



ADJUSTABLE-SPEED, REVERSIBLE

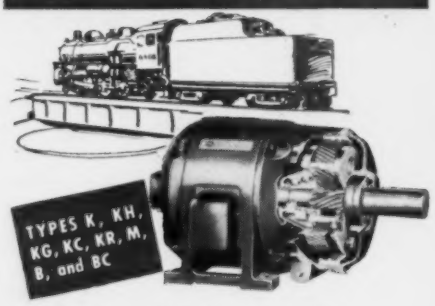
For rough, heavy-duty service and where it is desirable to obtain a large variety of accurately controllable speeds over ranges of more than 3:1 or 4:1.



½ to 200 hp at basic speeds of 100 to 1750 rpm
115, 230 volts
100 to 3500 rpm
Sleeve or ball bearings
Constant, adjustable, or adjustable-varying speed

Write for Bulletin GEA-1542

GEAR MOTORS



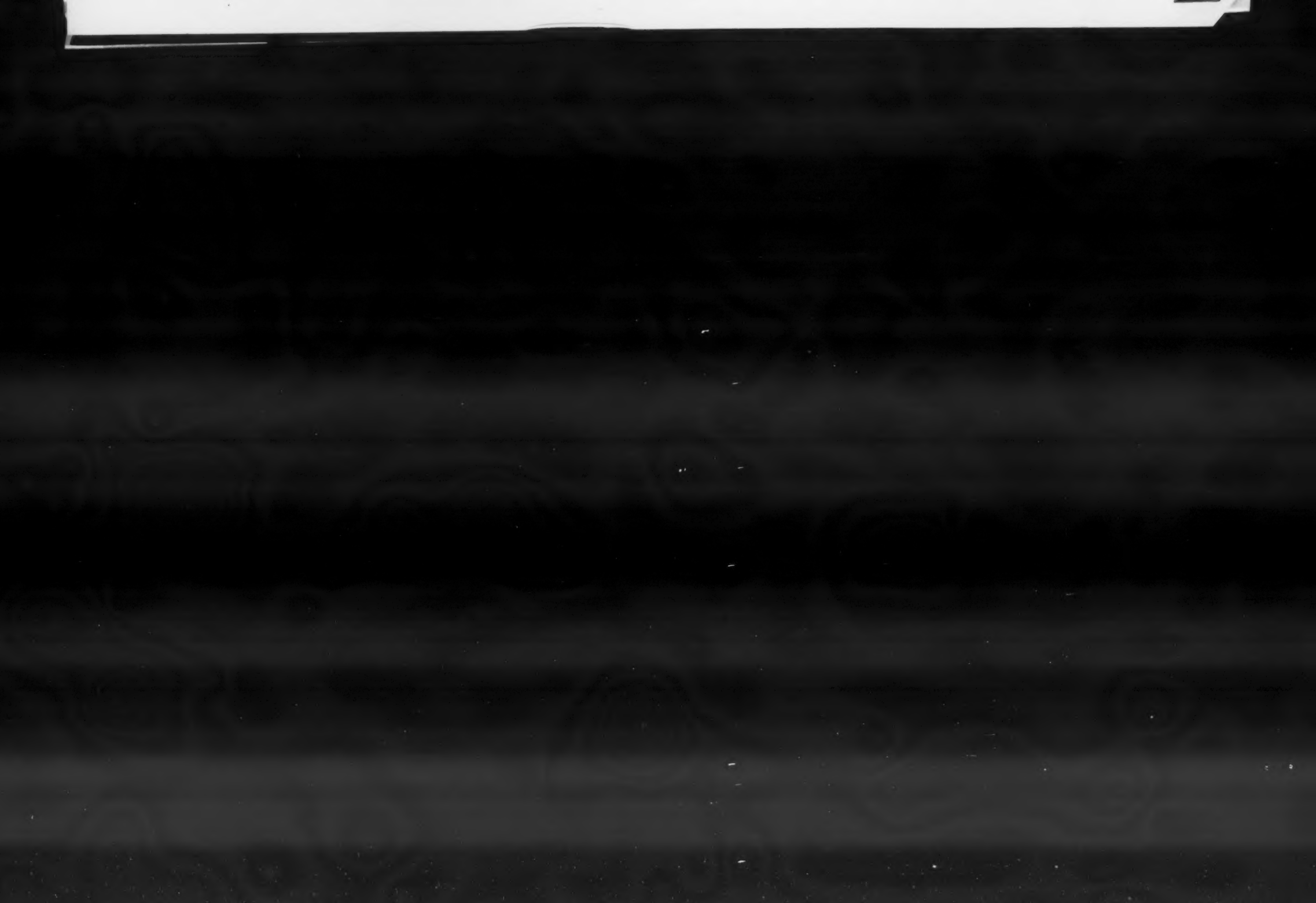
FRACTIONAL- AND INTEGRAL-HP

For applications where the load is constant and must be driven at low speed. A large variety of standard speeds below 800 rpm is available. It combines a normal-speed motor with a built-in, helical, planetary-reduction gear.

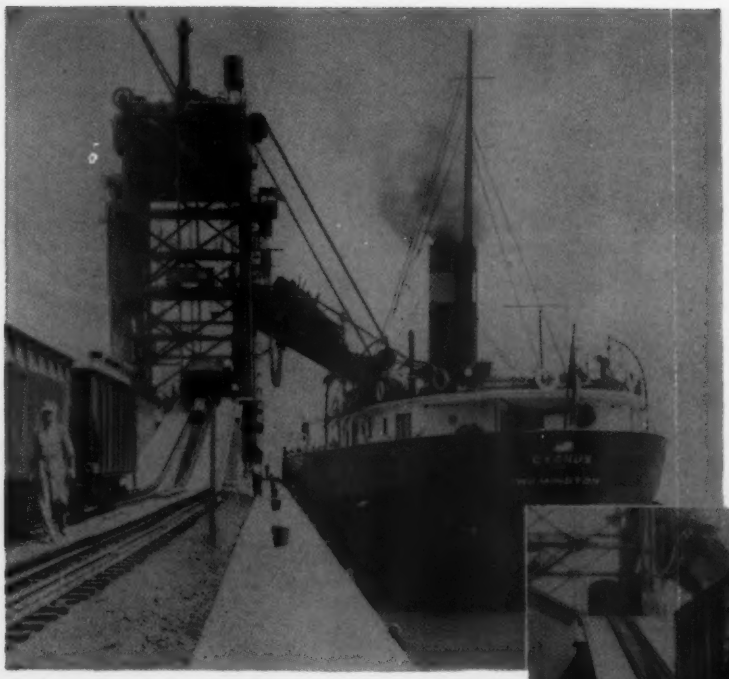
1/8 to 75 hp
Class I, 8- to 10-hour continuous operation per day
Class II and III, for severe service
Fractional-hp speeds from 197 to 5.7 rpm
Integral-hp speeds from 780 to 13.5 rpm
Available in open, splashproof, totally enclosed, and explosion-proof construction
Polyphase, 1 to 75 hp
Single phase, 1 to 3 hp
Direct current, 1 to 7½ hp

Write for Bulletin GEA-1437

GENERAL ELECTRIC



DUMPING A CAR A MINUTE *electrically*



With the precision usually associated with the dispatching of streamlined trains, the Pennsylvania's all-electric car dumper is loading coal into lake carriers at the rate of a car a minute. Vessels are being refueled and loaded with 12,400 tons of coal in four hours elapsed time between arrival and departure. Cars are unloaded so promptly that yard congestion is avoided; rolling stock is returned to revenue service quickly.

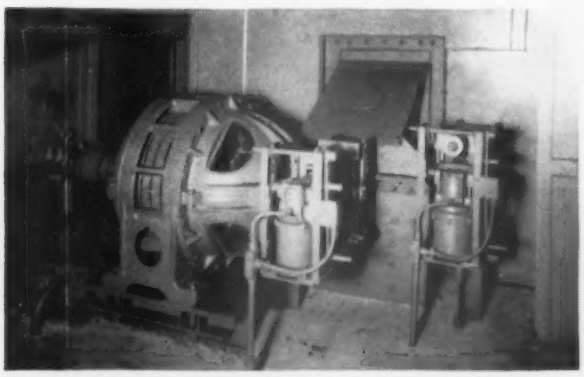
The electric motors and controls supplied by General Electric are designed to operate the dumper continuously at full capacity, and are so flexibly arranged that the dumper can still handle the maximum load even though a major piece of electric equipment should fail.

★ ★ ★ ★ ★ ★ ★ ★

This railroad lift bridge over Cape Cod Canal is one of the longest in the world. Four G-E wound-rotor motors—each 150 hp, 600 rpm—supply adequate torque to move the bridge under extreme load conditions. The Thrustor operated brakes bring the span smoothly to the end of its travel and seat it without shock.

IN projects representing large capital expenditures—such as car dumpers, ore unloaders, and lift bridges where reliability is of major importance—dependable operation must be certain. Responsibility for the design and co-ordination of the electric equipment should rest upon an organization qualified by long training and years of experience. Only in this way is investment adequately protected, and the maximum operating and maintenance economy obtained.

★ ★ ★ ★ ★ ★ ★ ★



G-E power selsyn motors with Thrustor operated brakes lock the driving motors on the two towers of the bridge in step to insure synchronous operation.

GENERAL ELECTRIC

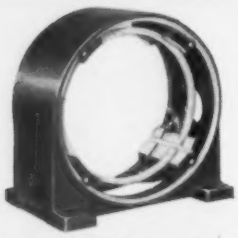
127-7-9580

TRI-CLAD MOTORS

REG. U.S. PAT. OFF.

Contribute to Longer Service Life In Three Ways:

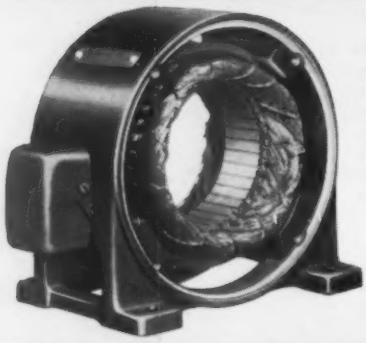
1. Extra protection against physical damage



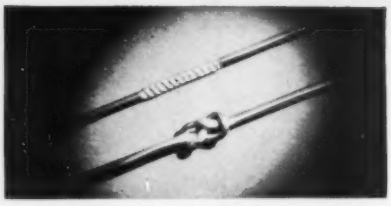
The one-piece cast-iron frame, with channel and rib sections, gives ample strength where needed without increasing the weight. The ribbed feet are cast integral with the frame to make them sturdy and rigid.

Smoothly proportioned end shields entirely enclose the upper portion of the motor, help it shed falling objects, external blows, and dripping liquids.

2. Extra protection against electrical breakdown

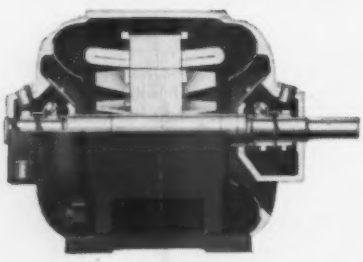


The windings of Tri-Clad motors are built from the inside out. Insulation is made strongest where it counts the most—on the conductors. Impregnated with a synthetic-resin varnish, the coils are remarkably resistant to oil, dampness, and mild fumes. End windings are Glyptal coated to produce a smooth, hard surface which discourages formation of surface arcs and resultant short circuits.

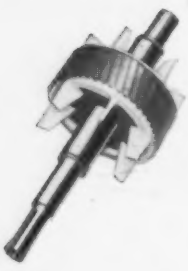


Because of the high dielectric strength of its coating, and its resistance to abuse, heat shock, solvents, and moisture, Formex wire is used in the coils. It does not become brittle and crack after years of service. It can be compressed until the copper is flattened, and it can be stretched 20 per cent and then wound on its own diameter—without breaking the dielectric film.

3. Extra protection against operating wear and tear



Double-end ventilation provides uniform cooling. Cool air is drawn in over the bearings, passes over the ends of the rotor and stator windings, and is discharged at the sides. Intakes, passageways, and outlets are large and smooth, producing low air velocity and quiet operation.



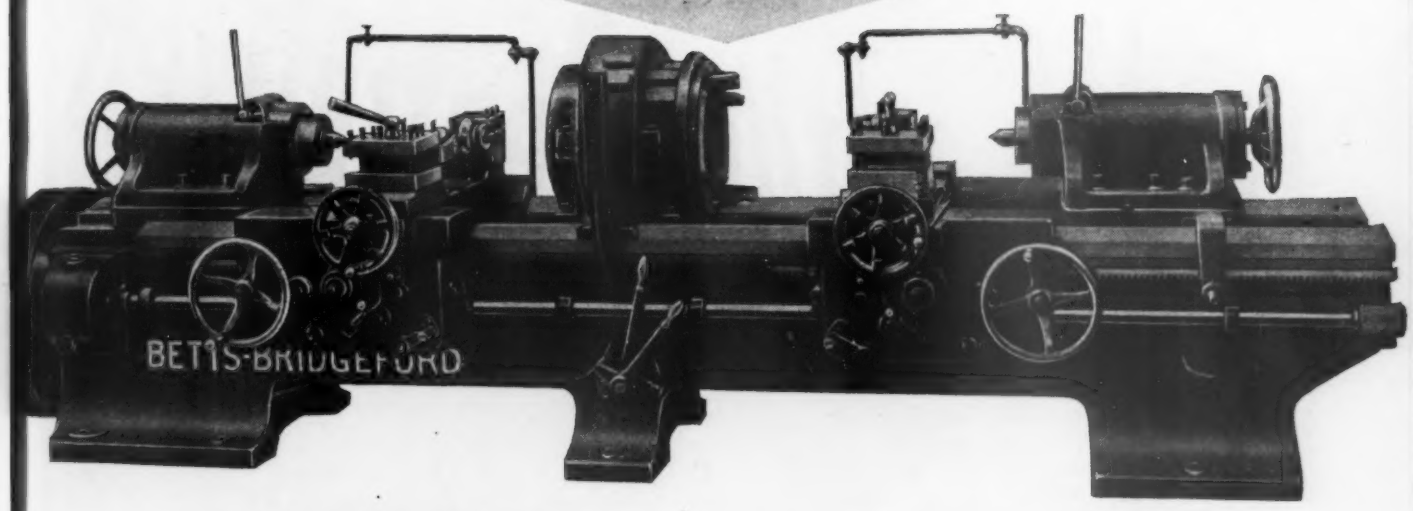
The practically indestructible low-inertia rotor has a one-piece, cast-aluminum winding with integrally cast fans for effective heat dissipation.

The ball bearings, completely enclosed in cast-iron housings, are protected against the entrance of dust, dirt, water, and corrosive materials. A pressure-relief greasing system prevents overgreasing and subsequent overheating.

The improved spiral grooving of the sleeve bearing provides positive oil distribution over the entire bearing surface, regardless of rotation or load. The new bearing proportions equalize bearing pressures, reduce operating temperatures, and increase the capacity.

APPARATUS DEPT., GENERAL ELECTRIC COMPANY, SCHENECTADY 5, N. Y.

For top grade axle work....
fast—accurate—economical

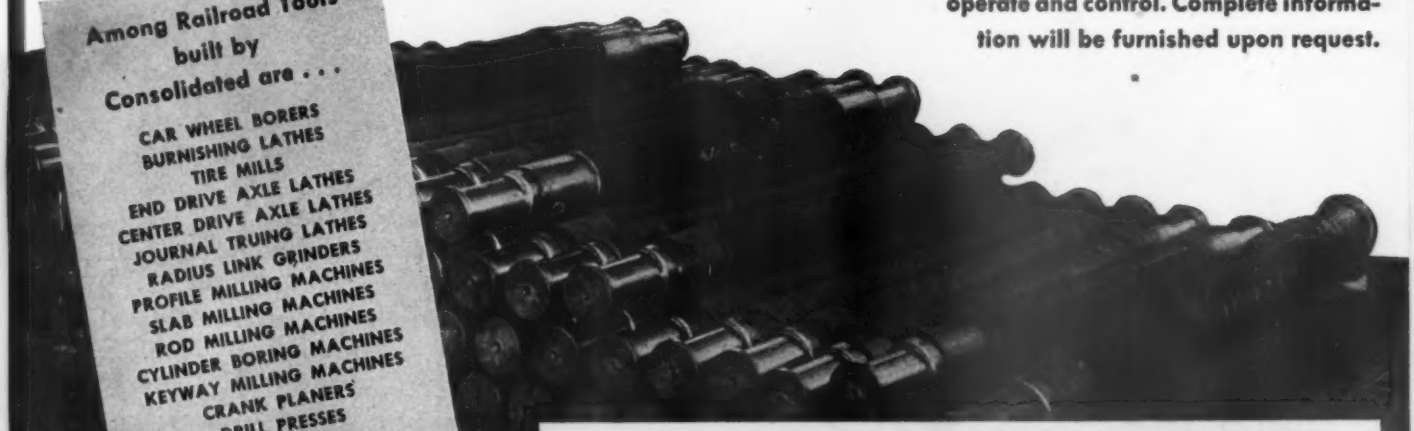


BETTS-BRIDGEFORD HEAVY DUTY CENTER DRIVE AXLE LATHE

The Betts-Bridgeford Center Drive Axle Lathe is designed for rapid turning and burnishing of journals, and for turning wheel fits on standard car axles from 4¼" x 8" up to and including 6½" x 12"—new axles or those to be reconditioned. Its massive, rugged construction insures long productive service. Accurate and fast. Simplified design, and elimination of complicated mechanisms make it convenient and easy to operate and control. Complete information will be furnished upon request.

Among Railroad Tools built by Consolidated are . . .

CAR WHEEL BORERS
BURNISHING LATHES
TIRE MILLS
END DRIVE AXLE LATHES
CENTER DRIVE AXLE LATHES
JOURNAL TRUING LATHES
RADIUS LINK GRINDERS
PROFILE MILLING MACHINES
SLAB MILLING MACHINES
ROD MILLING MACHINES
CYLINDER BORING MACHINES
KEYWAY MILLING MACHINES
CRANK PLANERS
DRILL PRESSES
AND OTHERS



BUILDERS OF RAILROAD SHOP TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

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At your fingertips —a quick answer to every packing requirement

CENTRALIZED CONTROL IN PACKINGS? Yes, it's been saving time and money for leading American railroads for more than 25 years . . . through the Johns-Manville Standardized Packings Plan.

Here's how this plan works: First, experienced Johns-Manville service engineers check every piece of machinery in your entire system to determine the correct style and size of packing for your every need.

In the packing survey compiled from this data (similar to one shown above), each individual packing requirement is listed and given a number. Copies of this survey go to every shop, power plant and storehouse in your system.

As a result, needed packings are thereafter ordered by number instead of by long, and often confusing, descriptions. Time and money are saved . . . errors minimized . . . guesswork eliminated. For more details write Johns-Manville at New York, Chicago, Cleveland, St. Louis or San Francisco.

JOHNS-MANVILLE JM PRODUCTS

PACKING Control

IN THE STORES

It's simple to pick the right packing off the shelf, when all your varied packing needs have been cataloged in one complete easy-reference guide.

Less stocks to be carried—no waste—no duplication—no measuring or guesswork on requisitions! The shop gets the right packing for the right service, quickly, simply.

And, when your stores need replacements from J-M, you avoid writing long descriptions. Just specify item numbers and quantities.

IN THE SHOPS

Your mechanics, too, are helped by this centralized Packing Control. No complicated requisitions are required. They get the correct packing for the job simply by looking up the part and asking for it by number. Sure they like it! The J-M Standardized Packings Plan takes a lot of the headache out of their work—and out of your maintenance budget.

In addition, J-M Service Engineers, continuously in the field, are prepared to check regularly on each packing to insure efficiency and long life.

THE BEST PLAN . . . BACKED BY THE BEST PACKINGS!

Over three-quarters of a century of successful packing service to transportation has established J-M leadership in packing design and manufacture. Keeping pace with railroad progress, J-M Research has improved or developed new packings for new railroad needs, in a continuing effort to make them the best packings money can buy. J-M Engineers are at your service to help you solve any unusual packing problem.

JOHNS-MANVILLE

87 YEARS OF SERVICE TO TRANSPORTATION

Insulation · Friction Materials · Packings · Refractory Cements · Building Materials

CP RAILWAY SPEED RECORDERS

PERFORMANCE charts of CP Railway Speed Recorders provide a permanent record of running speeds and distances traveled, together with acceleration, deceleration, forward-backward movements, and slippage. CP Railway Speed Recorders are available in two models: CP High Speed (10 to 120 mph) Recorders; CP Low Speed (0 to 75 mph) Recorders. Both models furnished in friction or angle drive to meet specific types of locomotive construction. Write for Bulletin 841.

CP Railway Speed Indicators

For service where permanent records are not required, there are two models of Chicago Pneumatic Railway Speed Indicators. These are identical in construction with the CP Speed Recorders – but without recording charts.

PNEUMATIC TOOLS
ELECTRIC TOOLS
HYDRAULIC TOOLS
ROCK DRILLS

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

HYCAR...comin' round the bend... on tomorrow's modern trains

There are important uses for HYCAR on every train...in every yard

FREIGHT and passenger trains of the future—the near future—will be the last word in modernity, super-streamlined, super-comfortable, super-efficient, super-safe. One modern material that will contribute to the new efficiency and dependability of the modern train is HYCAR synthetic rubber.

Wherever there's a resilient part—in train or yard—that's exposed to oil, dirt, abrasion, sun, heat, cold, or other destructive elements, that part should be made from HYCAR. In really tough service—hose, gaskets and seals, vibration dampeners, diaphragms, window strips, floor matting, and many other applications—parts made of HYCAR will give dependable performance over a long life, and save money by reducing maintenance and replacement expense.

We make no finished parts of HYCAR. We simply supply the raw synthetic rubber to fabricators who make the useful products. So we suggest that you examine the list of properties shown in the box at the right. *Then ask your supplier for parts made from HYCAR* to meet your specific requirements. You'll find that it pays to use HYCAR for long-time, dependable performance. *Hycar Chemical Company, Akron 8, Ohio.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE—insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

Reg. U. S. Pat. Off.

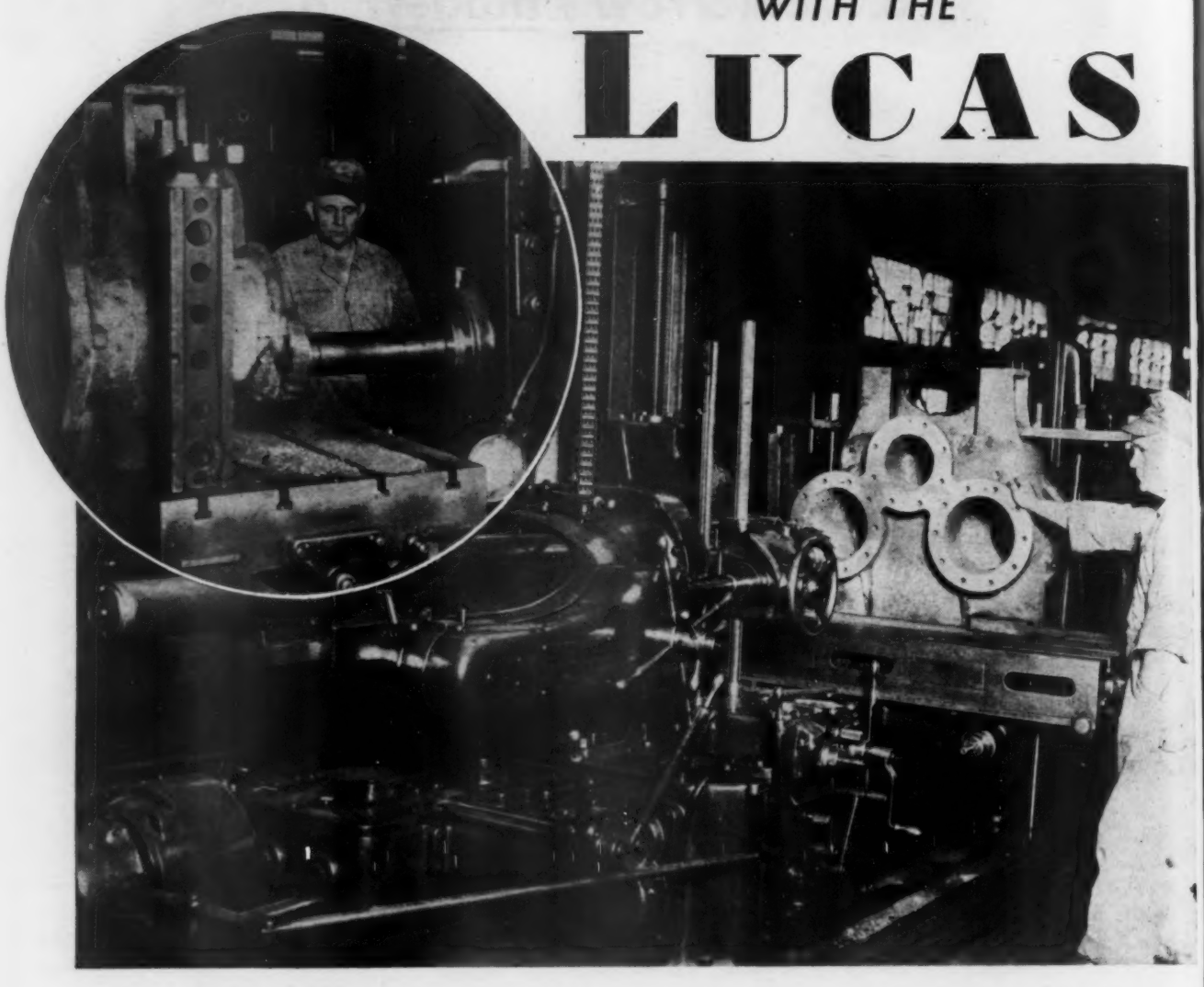
LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers

MORE PLANNED ECONOMY

WITH THE

LUCAS



SO WIDE is the range of jobs that can be completed on a LUCAS Horizontal Boring, Drilling and Milling Machine that shop foremen generally build their economy program right around the LUCAS. Work is planned so that this time-saving and versatile machine is kept busy all the time. Its scope of application not only covers many awkward and cumbersome parts which can be bored, drilled and milled in one set-up with big savings, but the LUCAS also speeds up the machining of many other jobs which are usually handled on some single purpose tool.

Illustrated above is a No. 42 LUCAS facing the head joints on the steam end of a compressor pump head. When this operation is completed, the LUCAS will also bore the cylinders. In addition to saving time on set-ups, the LUCAS insures great accuracy and therefore, longer service-life from all locomotive parts machined on this versatile Horizontal, Boring, Drilling and Milling Machine.

LUCAS MACHINE TOOL CO.

CLEVELAND, OHIO

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WE STOCK IT IN 29 PUNCHING DIAMETERS

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and as this is but one of our twenty-one standards you can imagine the enormous quantity of Punches carried in stock to meet immediate demands. Besides, for each standard Punch there is a standard Die, consequently our stock of Dies is as varied as our stock of Punches.

WE MAKE PUNCHES AND DIES FOR ALL THE SHAPES SHOWN

Small Tools THE CLEVELAND PUNCH & SHEAR WORKS COMPANY *Cleveland, Ohio*

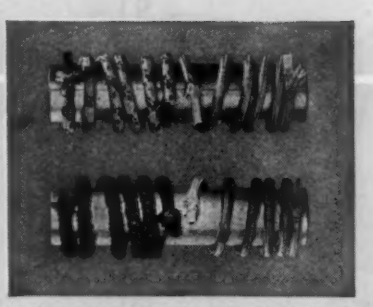
NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

"—and now as to postwar planning, can we be sure of getting all of the **CHAMPION WELDING ELECTRODES** *we'll need?"*

DOW CORNING

SILICONES

revise old concepts of the properties of materials



Cable insulated with Dow Corning Silicone rubber (at right) shows no change after one hour at 250° C., in contrast with organic rubber, which has melted and exuded freely through the braid.

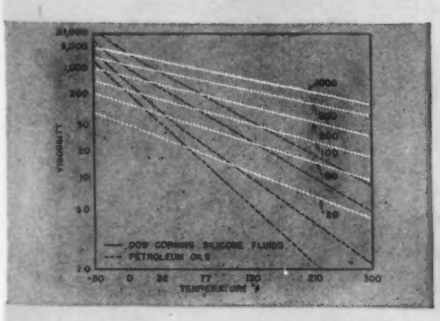
The excellent condition of the stock at left, protected with silicone based paint, indicates the ability of such finishes to withstand moisture, oxidation, ultra-violet rays and temperatures up to 500°F.

American industry has been quick to prove the outstanding advantages of Dow Corning Silicone products. The greater heat stability, inertness to water and chemicals, and the excellent dielectric properties of these high polymeric substances radically change old concepts of the properties of materials.

Among DC Silicone products commercially available are: Fluids notable for low rate of viscosity change over a wide temperature range; Lubricating Greases for service at temperatures down to —70°F. and up to 400°F.; special Stopcock and Plug Cock Greases; Varnishes and Resins for impregnating, coating and bonding, and for waterproofing asbestos, mica and Fiberglas cloth; Silastic*, a rubber-like silicone material for molding, coating, extruding and laminating.

Inquiries are invited.

*TRADE MARK, DOW CORNING CORPORATION



Here is graphic illustration of the fact that Dow Corning Silicone fluids undergo strikingly little change in fluidity over a wide range of temperatures.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

New York Office: Empire State Building

Dow Corning

FIRST IN SILICONES

LIFT

and HOLD . . .

Only Malabar Hydro-Mechanical Journal Masters are available in a 7 inch model. This low height permits spotting jack under spring bracket, in yards with paved surfaces. Specify Malabar the Lift with a Lock, for positive protection from settling or accidental lowering of heavy loads

MALABAR

A PRODUCT DIVISION OF

MENASCO MANUFACTURING COMPANY

Dynamics • Hydraulics •• BURBANK, CALIFORNIA

BALANCE
MEANS LONGER LIFE FOR RAILROAD EQUIPMENT

GISHOLT DYNETRIC BALANCING MACHINES*

Actual records show that reconditioned traction equipment, when properly balanced on Gisholt Dynetrics, has 2 to 3 times its original life. If you aren't taking advantage of Dynetric Balancing to keep equipment running longer and more smoothly, write us for full information.

**A development of Westinghouse Research Laboratories.*

FOR THE LOCOMOTIVE REPAIR SHOP

The Gisholt Type U Dynetric Balancing Machine is used for balancing traction motor armatures, Diesel-electric generator armatures, Diesel crankshafts, and other parts weighing from 250 to 6,000 pounds.

It takes but a few minutes with a Gisholt Dynetric to assure the accurate balance that eliminates the destructive vibration that causes excessive bearing loads, unnecessary wear and shortens the life of rotating parts. Whatever the part may be, from ½ ounce to 50 tons, there's a Gisholt Dynetric to handle it.

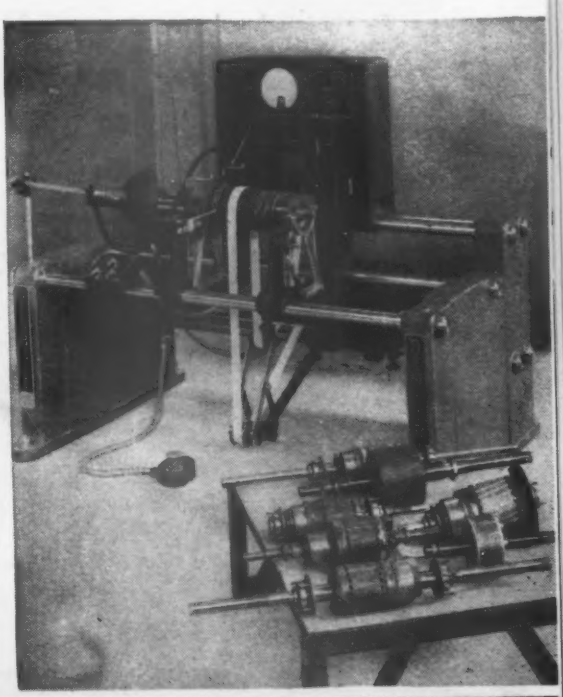
FOR THE ELECTRICAL SHOP

The Gisholt Type 3S Dynetric Balancing Machine is used for balancing auxiliary power generators, car heating, air-conditioning and ventilating equipment, and for any other rotating parts weighing from 15 to 300 pounds.

All auxiliary equipment is balanced by the original manufacturers. But it should be rebalanced when it is reconditioned to insure maximum life with the smoothest possible operation.

Gisholt Dynetric Balancing Machines are simple to operate, provide accurate static and dynamic balance more quickly and accurately than any other known means. Gisholt Balancing Machines soon pay for themselves in the longer life and reduced maintenance costs on many types of railroad equipment.

For complete information as to how Gisholt Dynetrics are being used in railroad shops, write us.



GISHOLT

GISHOLT MACHINE COMPANY

1293 East Washington Ave. • Madison 3, Wis.

Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

ANOTHER EXCLUSIVE HYPRO FEATURE

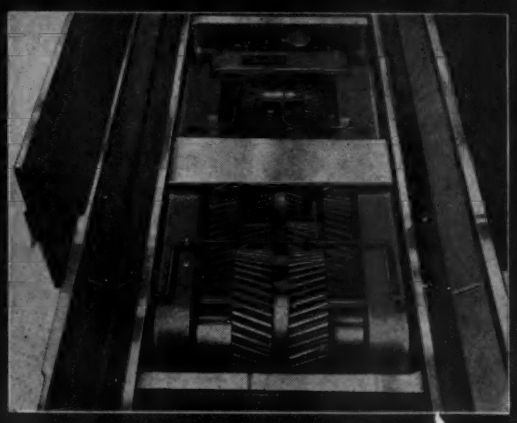
Complete Herringbone Twin Gear Table Drive

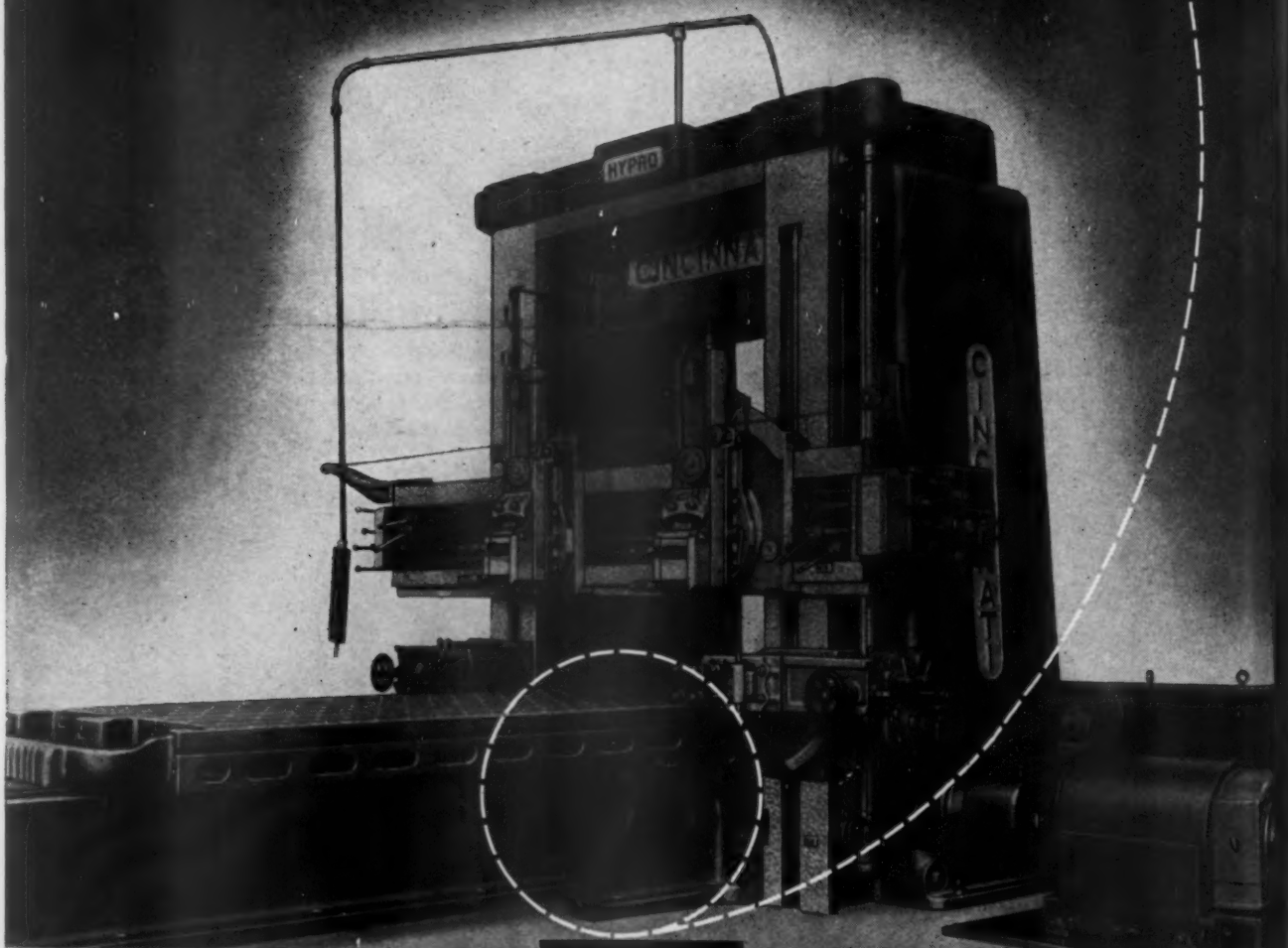
In no other planer will you find the complete steel herringbone twin gear table drive.

The twin gear train, including the bull wheel and rack, is of the herringbone type. This construction gives a smooth, continuous and even flow of power through greater tooth surface and eliminates side thrust.

There is no shock when the load is transferred from tooth to tooth, eliminating practically all wear. The gears work silently and without vibration on their large diameter shafts which are hardened full length and ground at the journals. All gears and pinions are made of steel and flame hardened.

This is one of those exclusive features that make the Cincinnati Hypro a buyer's choice.

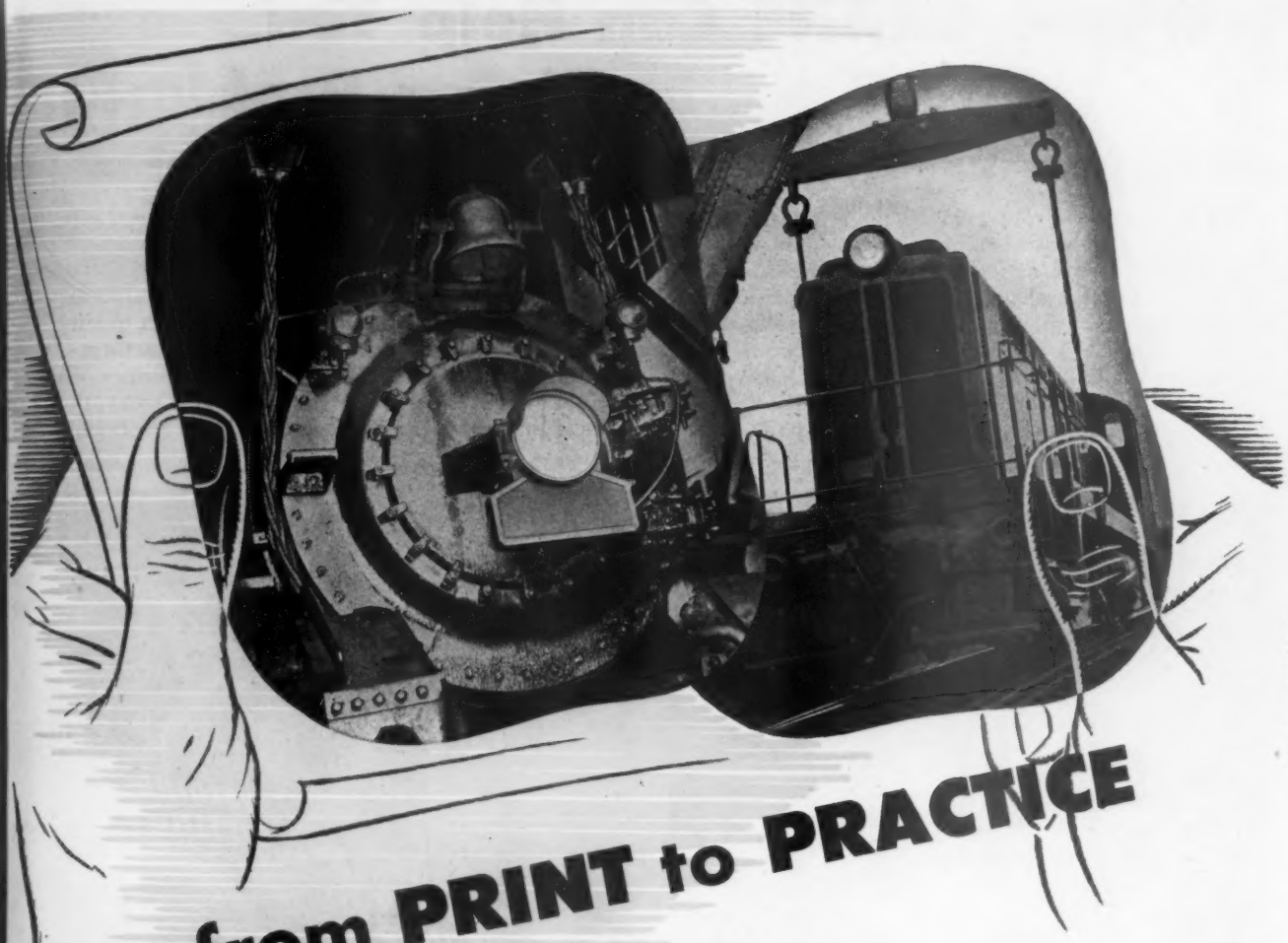




THE CINCINNATI HYPRO PLANER COMPANY

PLANERS - BORING MILLS - PLANER TYPE MILLERS

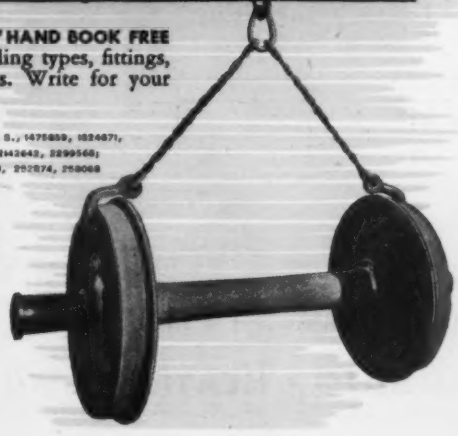
CINCINNATI, OHIO



from PRINT to PRACTICE

RIGGERS' HAND BOOK FREE
Shows sling types, fittings, capacities. Write for your copy.

*PATENTS: U. S., 1475889, 1824671, 2142641, 2142642, 2299560; CANADIAN, 252874, 258068



Give us the "picture"... we'll fit your routine lift or special job with the correct YELLOW STRAND *BRAIDED* SLING*

It can be a blueprint, sketch or description. Given an accurate "picture" of your lifting problem, we will suggest an efficient Yellow Strand *Braided* Safety Sling with these advantages: increased protection for men and loads, easy-to-manage flexibility, high kink-resistance, light weight.

Should the load be cradled in a basket hitch (like a smokebox) ... kept level (like Diesel engine units)? Is it slippery, requiring a choker grip (like a piston rod, set of flues or brake rods)? Do you want to make the lift at the drawbar ... by the edges ... through eyebolts? For scores of general shop, storeroom, yard and wrecker operations there are widely-used types of Yellow Strand *Braided* Slings. But if you need an original sling—perhaps with spreader bar or special hooks—we'll design a custom job embodying stout Yellow Strand Wire Rope and the time-saving patented *braided* construction.

Send details of your application now and let B & B engineers offer a recommendation. Broderick & Bascom Rope Co., St. Louis 15, Mo. *Branches:* New York, Chicago, Houston, Portland, Seattle. *Factories:* St. Louis, Seattle, Peoria.

ARMY E NAVY

BRODERICK & BASCOM

Yellow Strand

BRAIDED SAFETY SLINGS

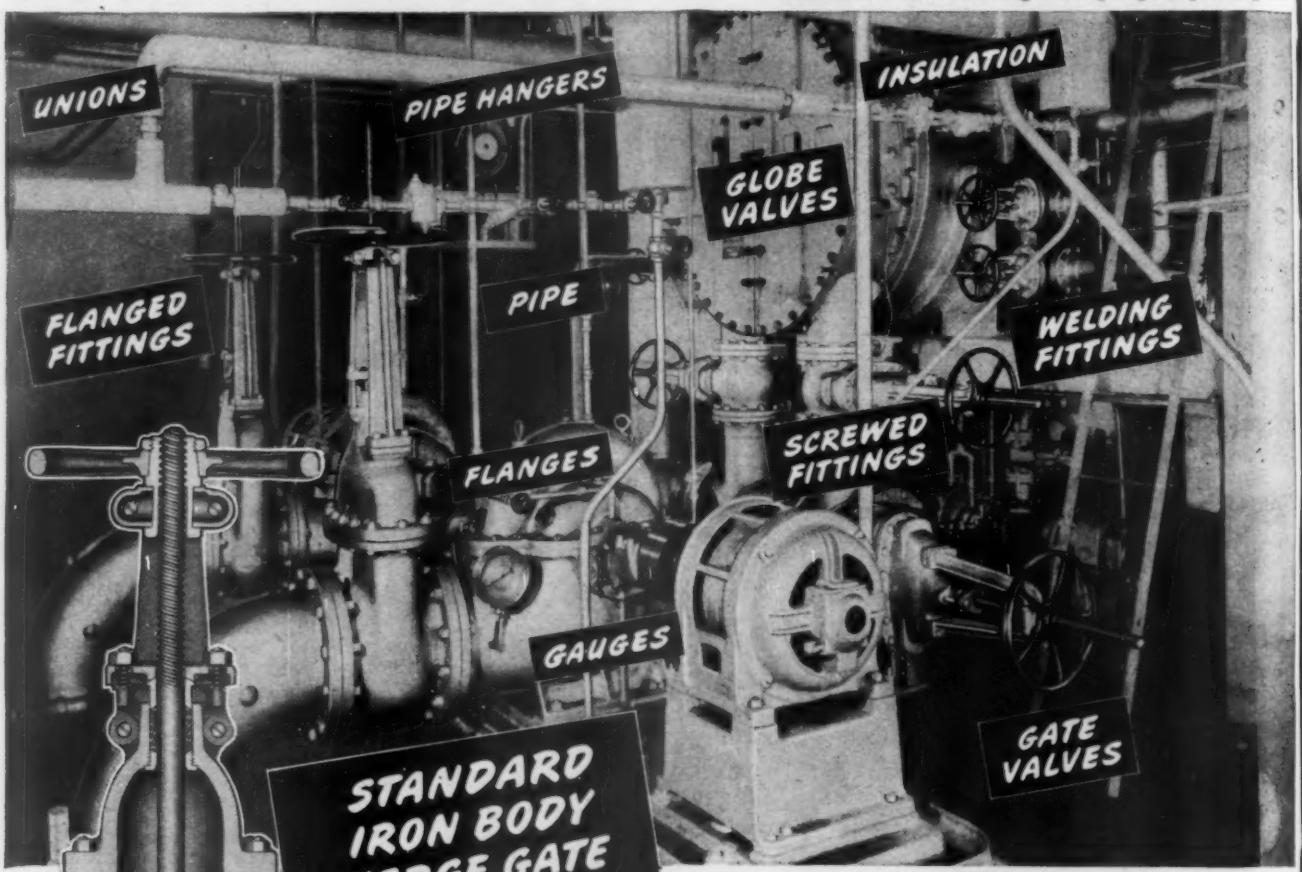
Where CRANE Can Help You in Piping Problems

ONE SOURCE OF SUPPLY • ONE RESPONSIBILITY • ONE STANDARD OF QUALITY

The conditions under which your piping systems operate govern your choice of piping materials. You can best determine the exact requirements. In that task you will find the Crane line a *truly* helpful service. By giving you the world's most complete selection of piping equipment for all applications, Crane makes it possible to get exactly what you need. You choose with complete confidence, for Crane, with 90 years' experience, points out clearly the distinct advantages of each type of valve, fittings and piping accessory.

In choosing Crane materials, you simplify any piping job. One order to your Crane Branch or Wholesaler covers all your needs. Uniform quality in all materials—plus single responsibility for them—helps keep installations at peak efficiency longer—at minimum cost. For maintenance or new work, the Crane line answers all piping equipment problems.

Condenser and circulating water pumps in power plant



SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** are suited for many services in factories and power plants, at all working pressures up to 125 pounds steam. Brass trimmed valves are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O. S. & Y. and Non-Rising Stem patterns. See page 101 of your Crane Catalog.

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16 in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2 in., use Crane Clamp Gate Valves.)

CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill. • *Branches and Wholesalers Serving All Industrial Areas*

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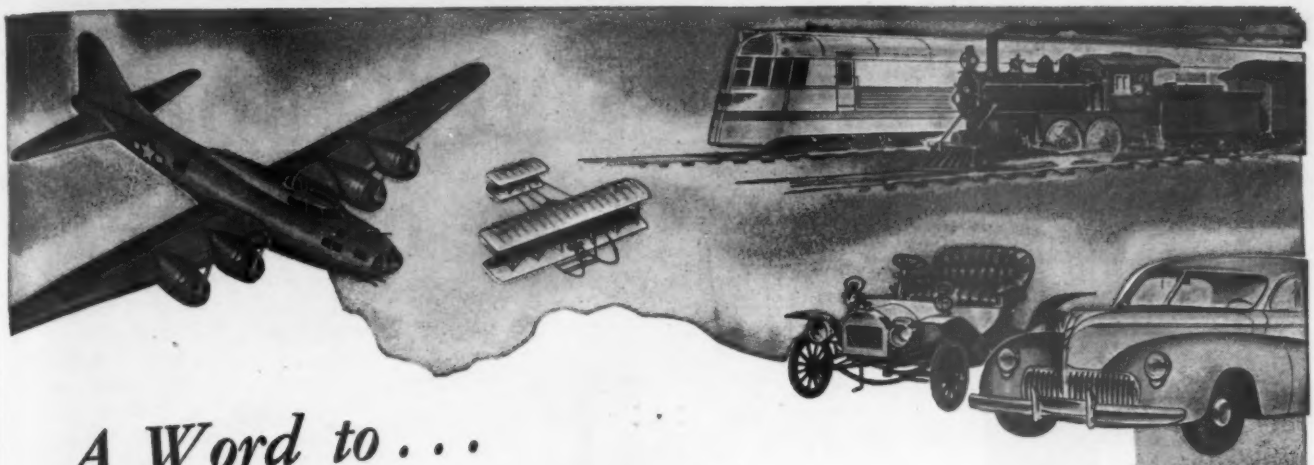
VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS



A Word to . . .

RAILROADERS!

• NOW is the time to modernize your plant—to get rid of inherited equipment and old, outdated equipment. Obsolete machinery reduces plant efficiency and increases manufacturing costs. And you cannot afford to handicap yourselves in the coming era of intensive competition.

Murchey machines and tools, modernized to the nth degree, proved their capacity, during the rigorous needs of war, to speed up production and to deliver precision and volume production. Their cost-cutting, time-saving, speed-assuring role is just as important NOW!

For over 40 years, Murchey Self-Opening Die Heads, Collapsible Machine Taps, Thread Milling Machines, Tapping Machines, Bolt and Pipe Threading Machines, and all other threading tools, have been recognized as the standard by which all threading equipment is judged and evaluated.

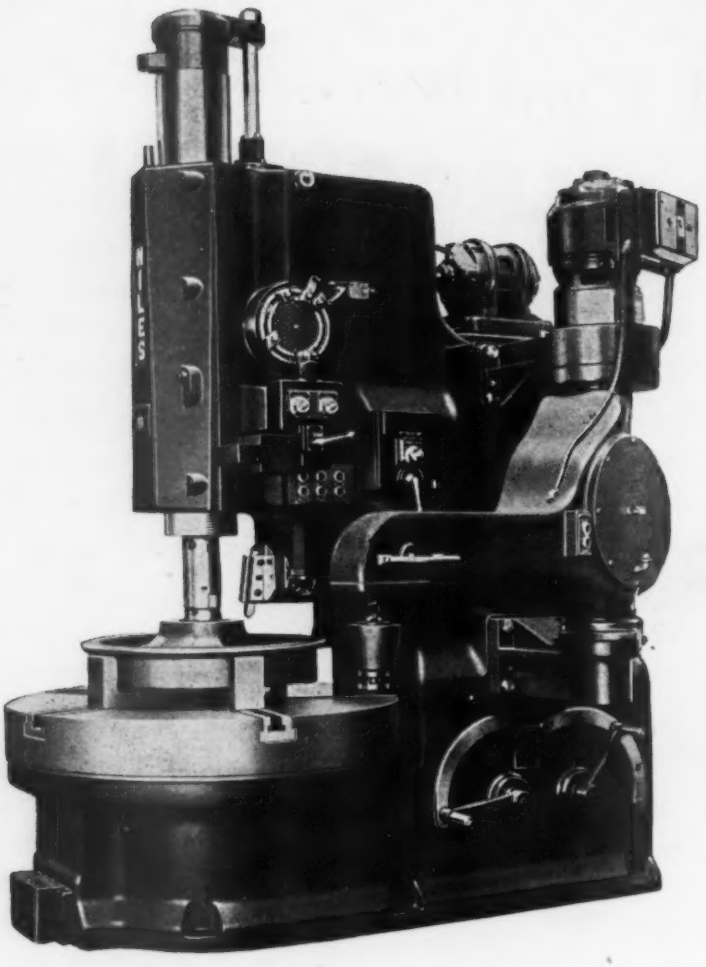
Murchey continues "Ahead of The Times"! In greater numbers than ever before, industries faced with any variety of threading problems, turn to Murchey as the organization best qualified to help them out of their difficulties. And Murchey pledges its resources—trained skill—engineering leadership — to maintain their confidence. Past, Present and Future, the same always holds true . . . *"You Can Depend on Murchey."*

MURCHEY MACHINE & TOOL COMPANY
DETROIT 26, MICHIGAN

MURCHEY

NILES

CAR WHEEL BORER
EASY TO OPERATE



The Niles Hydraulic feed wheel borer will rough, finish machine and chamfer the bore, also face the hub of cast iron or steel wheels with a minimum of machining time and effort on the part of the operator.

Write for Catalogue Covering Complete Line of Niles Tools including driving wheel lathes, car wheel lathes, car axle lathes, car journal turning lathes, locomotive journal turning lathes and locomotive wheel quartering machines.

GENERAL MACHINERY CORPORATION

GENERAL MACHINERY CORPORATION

HAMILTON, OHIO, U. S. A.

The Niles Tool Works Company — The Hooven, Owens, Rentschler Company

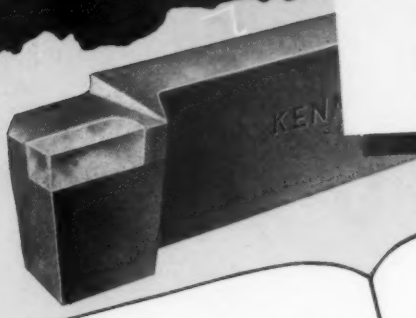
General Machinery Ordnance Corporation

Here's What KENNAMETAL HAS DONE

STYLE 11HD
with "Clamped-On"
Kennametal blank

STYLE 11
with "Screwed-On"
Kennametal blank

that other cutting tools COULD NOT DO!



STYLE 1

on Sandy Iron Castings

Turned cast iron piston trunks—21½" diameter x 45" long—high in silicon, manganese, and carbon; very sandy surface; chilled around port holes. Showed practically no wear after machining three complete castings. This was Kennametal's *new and improved* tungsten carbide Grade K6.

Other makes were unable to take shock of interruptions, or withstand the highly abrasive cutting—could not complete one casting.

—o—

on Tough, Aluminum Bronze

Rough turned scaly Ampco metal bar stock—6" diameter x 14" long—continuously for 8 days. After turning 224 pieces (equivalent to 85 miles of lineal cutting) Kennametal tool did not need regrinding.

With other tools only one-fourth as many pieces could be machined before resharpening was needed.

—o—

on Chrome Nickel Steel

Rough turned very scaly chrome nickel forging —2' diameter x 10' long—in 30% less time, and with triple the tool life obtained from other tools, which could not stand up under the plunge cut through scale.

on Monel Metal

Bored 4½" hole in 6' long solid monel metal forging, to accurate size, in 32 minutes. HSS tool required 10 hours; sometimes produced up to .040" taper, due to wear, which required reboring.

—o—

on 14% Manganese Steel

Successfully rough and finish bored and turned huge casting. (High manganese steel is usually ground rather than machined because it hardens under cutting tool pressure.)

—o—

on "Everyday" Jobs, Too

The tool that takes tough jobs in stride is the one to use on routine production runs where overall cost-per-piece is the important factor. This is conclusively proved by official reports covering consumption of cemented carbides used during the war for machining 105mm shells:

- Where cemented carbide tools other than Kennametal were used, average carbide consumption per shell produced was approximately 3 *calculated grams.*
- In typical plants using Kennametal exclusively, average consumption per shell was *only ½ gram.*

In other words—Kennametal Tools were up to 6 times as serviceable—a fact of utmost significance to all who must now manufacture post-war products—*economically.*

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL *Inc.*, LATROBE, PA.

MACHINE TOOLS

RECONVERT NOW!

WITH GOVERNMENT-OWNED INDUSTRIAL EQUIPMENT ... AVAILABLE THROUGH

RFC

TODAY— vast stocks of government-owned Machine Tools and Industrial Equipment are surplus as a result of cancellation of war contracts.

Machine Tools and Industrial Equipment will be disposed of by Reconstruction Finance Corporation. The supply is sufficient to meet all requirements of industry.

Submit your requirements now, in triplicate, to the nearest RFC Regional Office listed below. State your needs clearly, grouping various types of equipment.

In case your local RFC Regional Office cannot fill your specific needs, it will endeavor to locate the tools you need from other RFC Regional Offices.

• • • •

RECONSTRUCTION FINANCE CORPORATION

A DISPOSAL AGENCY DESIGNATED BY THE SURPLUS PROPERTY BOARD

Agencies located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas • Denver Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

102

OLIVER

RAILROAD FASTENERS

Help make better
Post-War Cars or Locomotives

Alloy steels, heat treatments, modern manufacturing methods and other technical advances found in Oliver Railroad Fasteners are distinctly helpful in working out improved designs for post-war railroad equipment. Higher tensile and fatigue strengths permit overall weight reductions. Improved manufacture means better fits, tighter joints.

For car and locomotive work, Oliver provides studs, bolts, nuts and rivets especially designed for railroad service. Ask your Oliver representative about them.

OLIVER
IRON AND STEEL
Corporation

SOUTH TENTH and MURIEL STREETS · PITTSBURGH 3, PENNA.

READY TO ROLL

With clock-like regularity and no lost motion, America's railroads are speeding our fighting strength to where it's needed most.

But before the "clear" signal can be given to any train crew, plenty of backshop preparation is necessary.

On the job, with a full line of railroad cleaners to help keep 'em pounding the rails, is the Wyandotte Representative. With cleaners for every purpose, his specialty is helping railroaders save time on the turn-around — to get maximum service out of every locomotive, tender, passenger coach or sleeper capable of going on the road.

He has cleaners made especially for railroad use. And each is a specialist at saving time, abor and money in going after carbon deposits, soot, grease and oil. They rush right lthrough the toughest backshop jobs.

Let the Wyandotte Representative show you what these products will do for you. He's always on call, ready to help. Just give him the high sign.

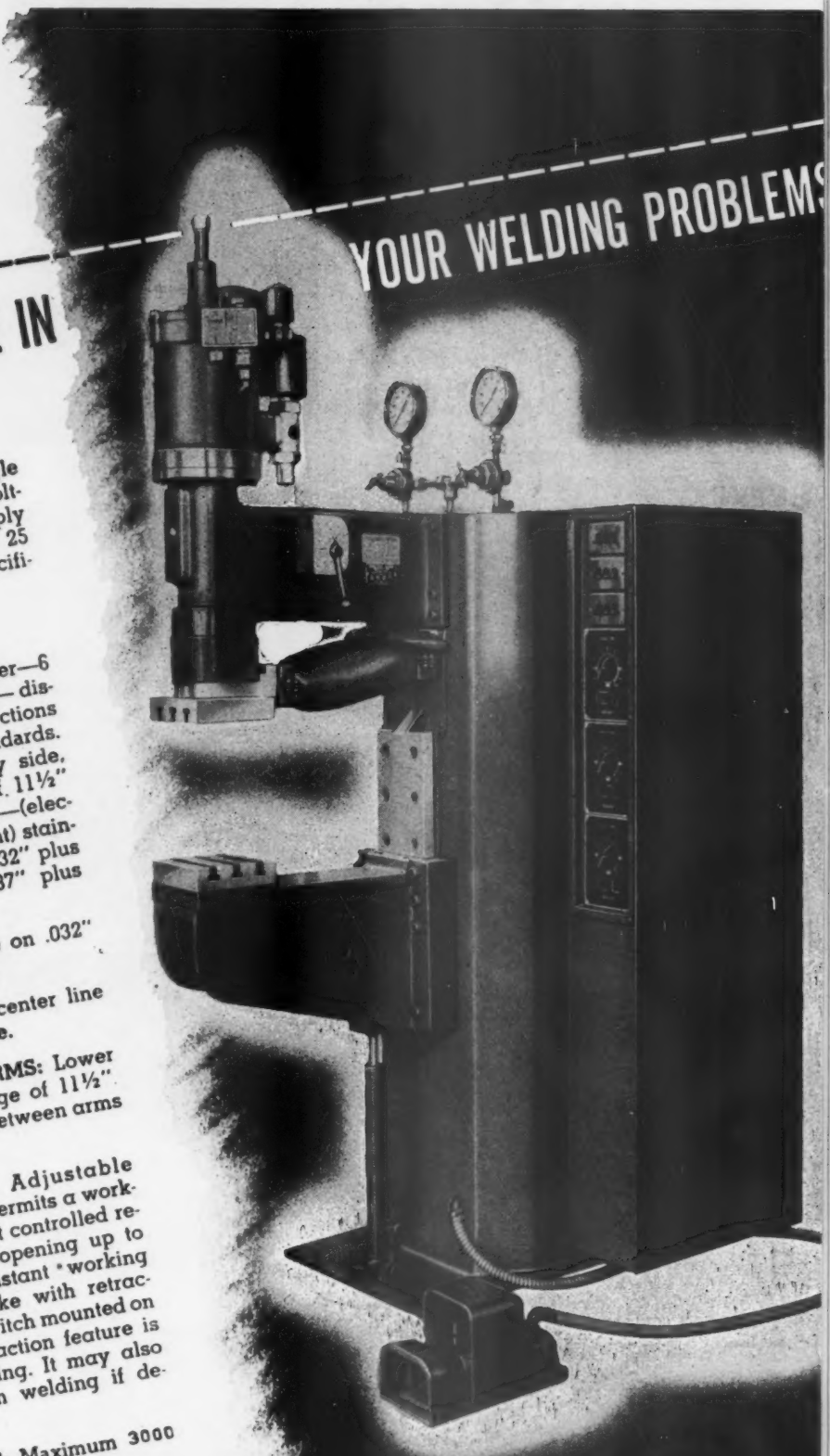
WYANDOTTE CHEMICALS CORPORATION • J. B. FORD DIVISION
WYANDOTTE, MICHIGAN, SERVICE REPRESENTATIVES IN 88 CITIES

Wyandotte
REG. U.S. PAT. OFF.

SCIAKY

4915 West 67th Street
Chicago 38, Illinois

USE FORGING PRESSURE IN YOUR WELDING PROBLEMS



rating:

150 KVA at 50% duty cycle. Single phase alternating current of one voltage and one frequency. Power supply may be 440 or 220 volts, 60, 50 or 25 cycles, according to the user's specifications.

performance:

CAPACITY: As a projection welder—6 projections on .080" plus .080"—distance between welds ¾"; projections in accordance with RWMA standards. Maximum current on secondary side, 31,000 amps. with a distance of 11½" between arms. As a spot welder—(electrode holders optional equipment) stainless or clean mild steel from .032" plus .032" up to and including .187" plus .187"

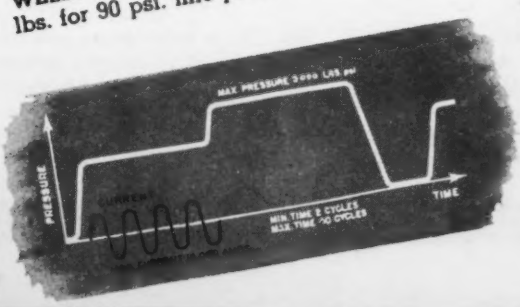
SPEED: 180 welds per minute on .032" plus .032" pickled mild steel.

THROAT DEPTH: 18" from center line of welding ram to face plate.

CLEARANCE BETWEEN ARMS: Lower arm adjustable over a range of 11½" Maximum working space between arms 21".

ELECTRODE STROKE: Adjustable stroke, retractible head, permits a working stroke of ½" with foot controlled retraction to give a total opening up to 2¾". Selection of constant working stroke, or working stroke with retraction is through toggle switch mounted on control panel. The retraction feature is designed for spotwelding. It may also be used for projection welding if desired.

WELDING PRESSURE: Maximum 3000 lbs. for 90 psi. line pressure.



PMC01-9

projection welder

BULLETIN 120-A

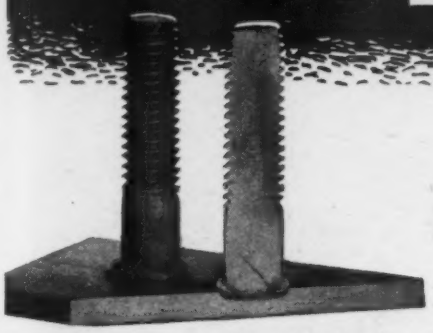
BEATTY

MACHINES WITH A PAST AND A FUTURE IN RAILROADING

● These are action photos, taken in busy railroad shops within the last few months. They show a variety of BEATTY machines, doing a variety of jobs . . . better, faster, more efficiently. The problems of your industry are familiar to BEATTY engineers. And the name, BEATTY, is familiar to men in your industry whose job it is to iron out production difficulties. If you have a problem in heavy metal working, let us work with you on it. Perhaps we have solved that same problem for someone else.

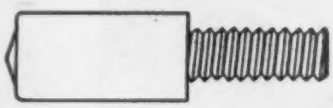
BEATTY MACHINE & MFG. CO., HAMMOND, INDIANA

How to secure electrical parts and wiring without drilling holes



This section view of a stud weld shows how Nelson Stud Welding completely fuses a stud to metal, eliminating drilling holes. And it's all done automatically!

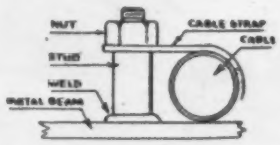
NELSON Arc Stud Welding has been used for years for marine electrical installations and is now available for general electrical construction. Thousands of guns are being used in more than 800 industrial plants and shipyards because stud welding saves *time* and *material*.



Above is a typical Nelson Stud. The pointed end is placed against the metal part and welded with the stud gun. The electrical parts are secured to the threaded end. Studs are manufactured in all standard lengths up to eight inches, in diameters from $\frac{3}{16}$" to $\frac{3}{4}$", and in many types and shapes. It takes less than *one second* to weld a Nelson Stud — operators secure 500 to 1000 studs in eight hours without difficulty.

The Model "H" Arc Stud Welder

The timing and operation are automatic and the use of the equipment is simple. The operator places a stud in the chuck of the gun, places it against the metal, and pulls the trigger. Instantly the arc fuses stud and metal and the operation is completed. A standard welding generator is used.



This complete stud assembly *(also see below)* shows the general application. One gun welds all lengths and diameters, producing a full fillet weld in any position. Studs secured by this rapid method equal in strength those secured by any other means.

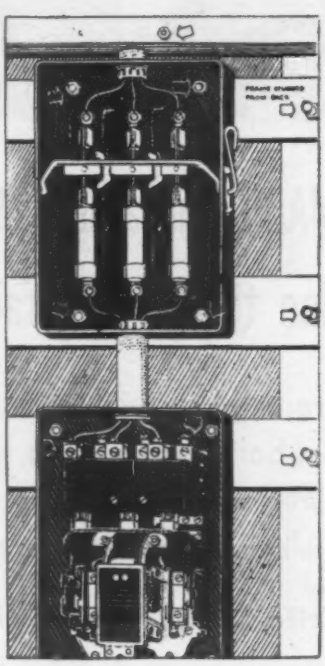
Switchboxes, outlet boxes, channels and gutters, inspection covers, etc., are also secured easily. For complete details, catalog, and prices, write to:

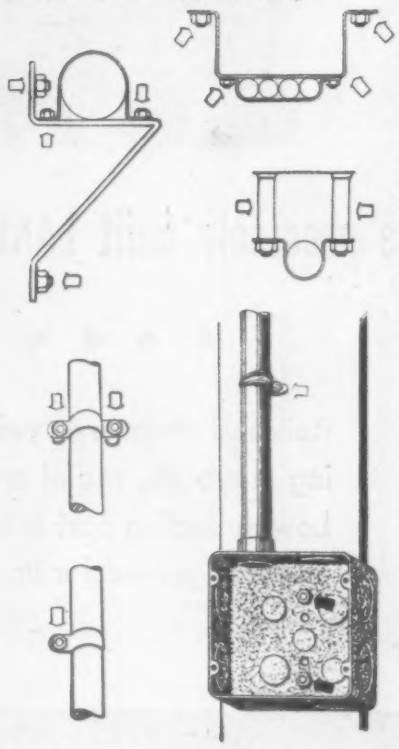
NELSON SPECIALTY WELDING EQUIPMENT CORP.

Dept. R., 440 Peralta Ave. San Leandro, California

Eastern Rep.: Camden Stud Welding Corp. 1416 South Sixth Street, Camden, N. J.

SUGGESTED STUD WELDING APPLICATIONS





NELSON ARC STUD WELDING

THE LANDMACO THREAD CUTTING MACHINE HANDLES RAILROAD STAY BOLT THREADING— *Efficiently and Economically*

The precisely built LANDMACO Threading Machine assures

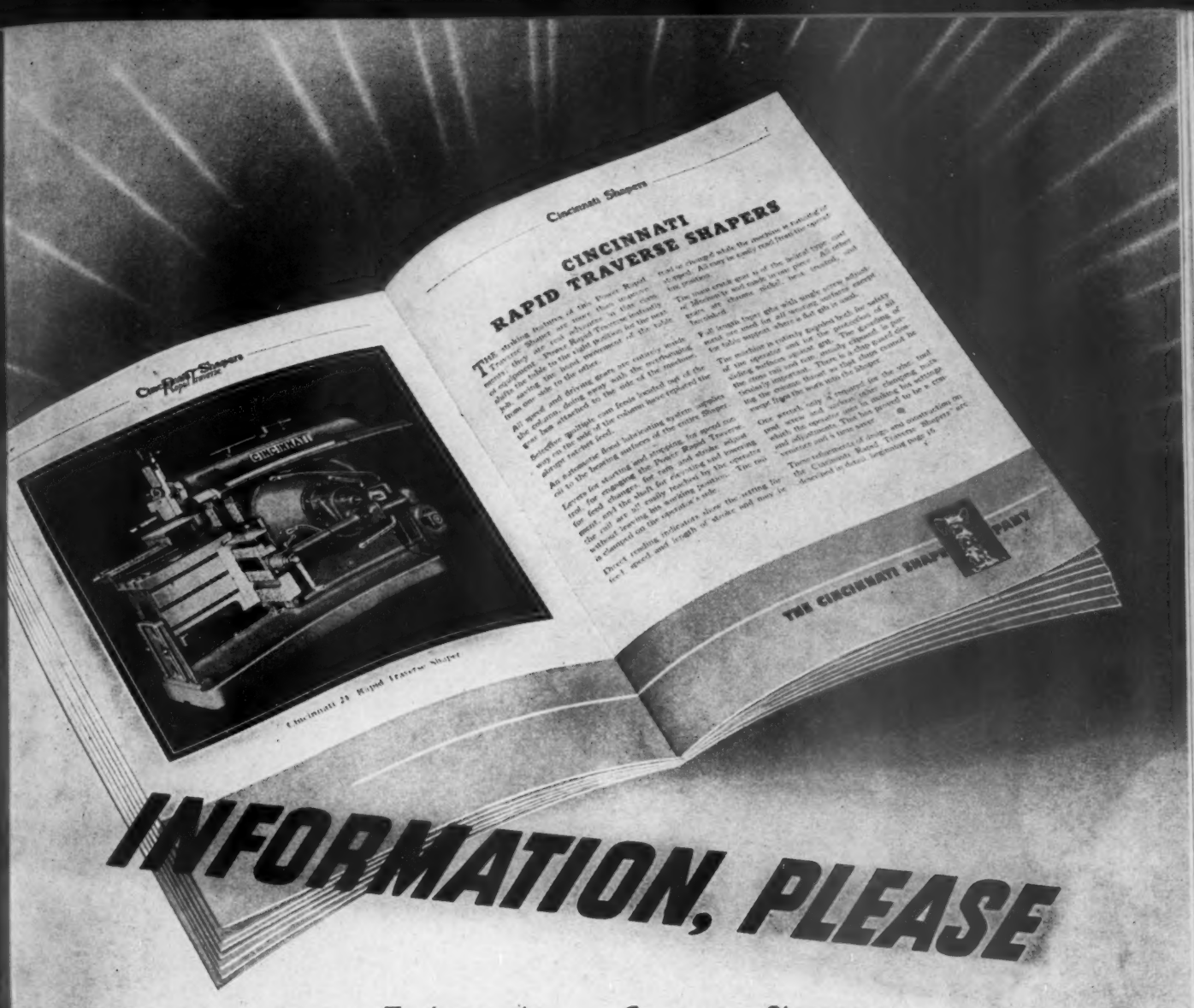
• • • • fine thread accuracy and low threading cost.

Railroad shops everywhere employ the LANDMACO Machine for threading staybolts, radial crown bolts, boiler studs, etc.—with excellent results. Low threading cost is assured since the machine is quickly and easily set up, and it is geared for unusually high threading speeds.

Write for Bulletin No. H-75

LANDIS MACHINE COMPANY, WAYNESBORO, PENNA, U.S.A.

THREAD CUTTING MACHINES • DIE HEADS • COLLAPSIBLE TAPS • THREAD GRINDERS



INFORMATION, PLEASE

Today, as ever, Cincinnati Shapers are indispensable in both the large plant and the small shop. Such Cincinnati features as: built in power rapid traverse to the table, multiple cam feeds, direct reading indicators, bring to the user of a single machine or of many machines an outstanding usefulness.

Write for informative book N-2 on the complete line of Cincinnati Shapers.

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

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glass fibers are absolutely incombustible

Thermal insulations for Passenger Cars,
Refrigerator Cars, Tank Cars and Locomotives.

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G·B MFG. CO
ESTABLISHED 1898

GUSTIN-BACON MFG. COMPANY

KANSAS CITY 7, MISSOURI

New York Philadelphia Chicago Tulsa Houston Fort Worth San Francisco

New "Push-cart" MAGNAFLUX* UNIT

Assures Fast, Low-Cost Inspection for Every Job in Roundhouse and Carshop

(Price Complete, $455.00 F.O.B. Chicago)

Even the smallest roundhouse, carshop or backshop can use this Type KT-2.5 Magnaflux unit to profitable advantage. It makes magnetic particle inspection practical and economical for all car, locomotive and similar parts. Use it to locate fatigue cracks and head off breakdowns of equipment in service.

Magnaflux is good maintenance insurance . . . It spots unseen defects accurately, reveals specifically the causes of probable failure . . . and does so at top production speed.

This unit, designed particularly for railroad use, is compact and rugged . . . Its all-steel welded frame stands plenty of shop punishment . . . Equipped with 16-inch rubber tired wheels—also with heavy eye bolts for convenient handling by an overhead crane.

Magnaflux equipment provides the thorough inspection that safety demands.

**Magnaflux, Registered U. S. Patent Office, a trade mark of the Magnaflux Corporation applied to its equipment and materials for magnetic particle inspection.*

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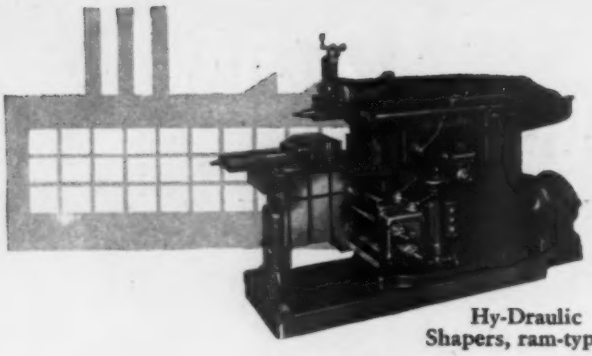
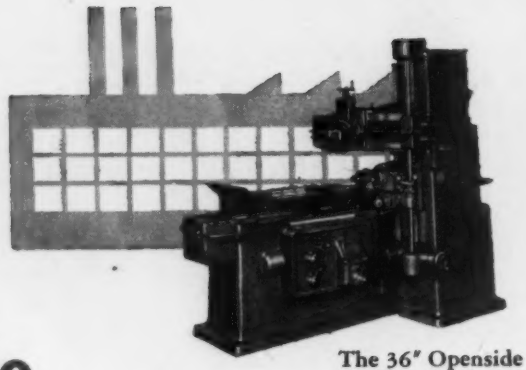


Hy-Draulic
Shapers, ram-type.



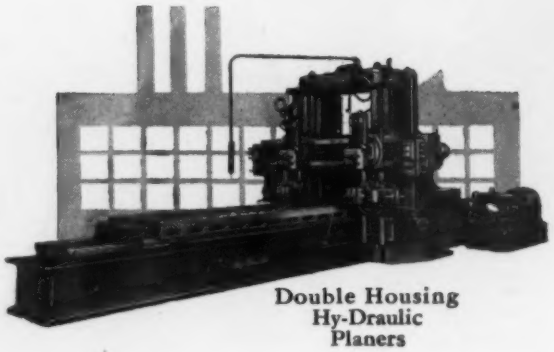
The 36" Openside
Hy-Draulic Shaper

An Invitation to the 14 and 20

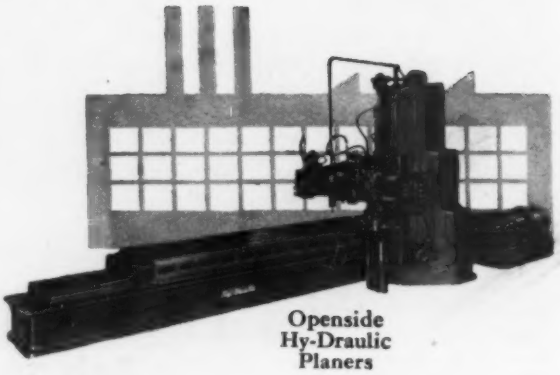
Of the plants studied in a recent survey, 14% report intentions to buy new planers and 20% new shapers.

Executives of these plants, and all others having similar intentions, are invited to investigate Rockford Hy-Draulic Planers and Shapers before making their decisions.

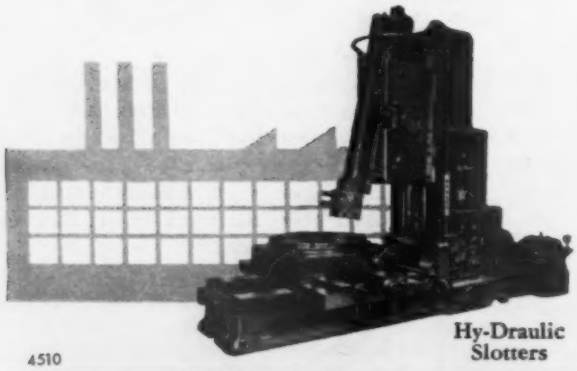
High grade in every respect, Rockford Hy-Draulic machine tools have the outstanding advantages of hydraulic drive and hydraulic feeds. They give you extra speed of set-up, ease of operation and rapid production of high quality work at low cost . . . plus values that have special importance right now. Write for details. Please mark your inquiry for the attention of Dept. 1925



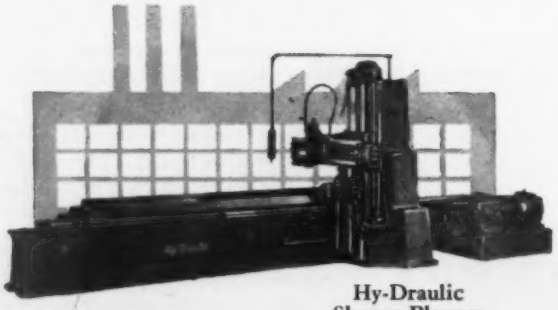
Double Housing
Hy-Draulic
Planers



Openside
Hy-Draulic
Planers



Hy-Draulic
Slotters



Hy-Draulic
Shaper-Planers

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Hy-Draulic

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS

Industry Endorses EUTECTIC Low Temperature WELDING RODS* and FLUXES

"THE MOST REMARKABLE DEVELOPMENT† SINCE THE INVENTION OF THE WELDING TORCH!"

Robert F. Miller - President of Pottstown Mfg. Co., Pottstown, Pa.

MANUFACTURER OF MACHINE PARTS AND ASSEMBLIES, INCLUDING TUBE BENDING AND WELDED SECTIONS

"We fabricated these aircraft ordnance parts with EutecRods 16 for steel (1300-1600°F.), No. 1800 for ferrous and non-ferrous metals (940-1120°F.), No. 190 for aluminum and alloys (950-1060°F.) and No. 1601 for alloy steel (1020-1250°F.). The use of these Low Temperature Welding Rods reduced our production costs materially. As many as 4000 pieces were produced with a No. 16 rod, and inexperienced girls were expertly welding tough and delicate parts after only a few hours of instruction from our welding specialist George Bauer. Because EUTECTIC Low Temperature Welding Rods can be applied with ease, we maintained a greater operating efficiency among our plant personnel."

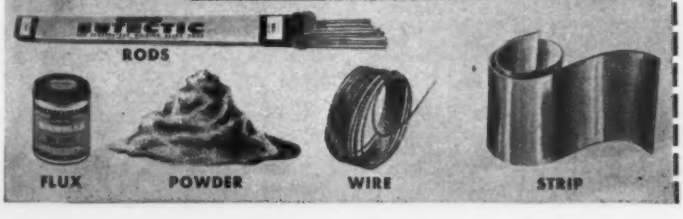
INVESTIGATE EUTECTIC TODAY

In production, EUTECTIC Low Temperature Welding Rods* play a vital role. Because they can be successfully applied by beginners—because they can be used with extremely low heat and produce welds that are more machinable, show less stress and distortion and exhibit consistently high strength—EutecRods and EutecTrodes are a growing factor in major civilian production work and are *rapidly displacing fusion welding and brazing.*

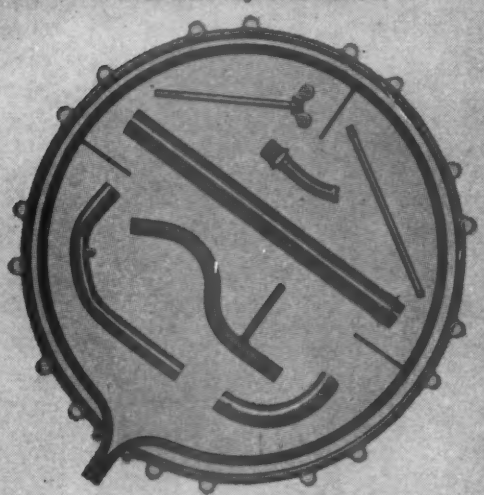
All EUTECTIC Alloys are now available for civilian production. By means of 48 specially developed Rods and Fluxes you can employ the many revolutionary advantages of EUTECTIC Low Temperature Welding. Get the facts today! Call in your local EUTECTIC Field Engineer and learn how EUTECTIC can be made to serve you.

Write for Eutectic's Civilian Production Folder EW-20 Today!

Castolin Eutectic



*Trade Mark Reg. U. S. Pat. Off.



†WHAT IS EUTECTIC?

EUTECTIC Low Temperature Welding Rods are a new type of welding alloys, which—

- **Bond to base metals well below the base metal melting point**
- **Avoid the dangers of stress and distortion characteristic of fusion welding**
- **Form exceedingly strong bonds through surface alloying**

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ORIGINATORS OF EUTECTIC LOW TEMPERATURE WELDING

40 Worth Street New York 13, N. Y.

Please send me complete facts about EUTECTIC Rods and Fluxes and information on how to purchase a selection of the 9 most important EutecRods for every day use. Dept. FN-1

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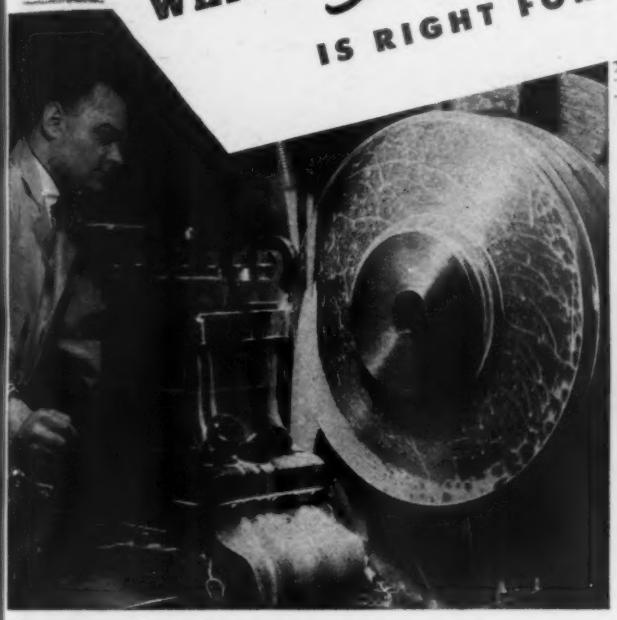
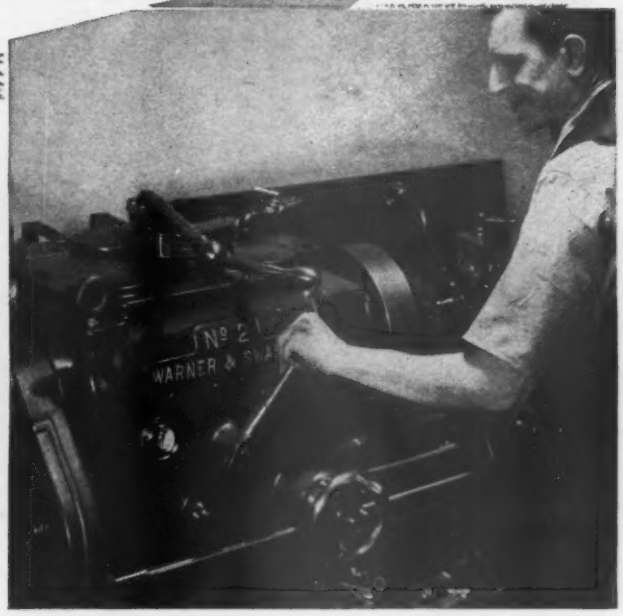
WHICH "Surplus" WARNER & SWASEY IS RIGHT FOR YOUR JOB?

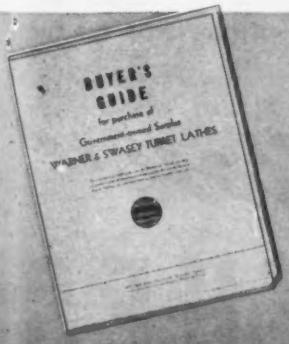




★ Just as the same sized hat will not fit every man, the same model Warner & Swasey Turret Lathe and set of tools is not best adapted to every job. Over a period of years, our engineers have designed and perfected a whole series of models and tooling set-ups purposely to help you get the very utmost in production. And in a new machine sale, our field engineers make certain that every customer gets the one that's right for his job!

Today, however, many government-owned surplus Warner & Swasey Turret Lathes are available. If you are planning to invest in a surplus Warner & Swasey—which you must buy "as is", contact our nearest Branch Office. After obtaining the model and serial number, all you need to do is give us this information. We will send you the date of shipment of the turret lathe—the way it was equipped when it left the factory, and the types and sizes of work for which we believe it is best fitted.

Write to us here in Cleveland, or see our nearest Branch Office. We'll be glad to help you get the most out of any Warner & Swasey you buy!



SEND FOR FREE COPY

The "Buyers Guide" will prove a valuable aid in helping you determine the proper Warner & Swasey Turret Lathe to suit your needs in the purchase of surplus turret lathes. To get a copy, just write to us here in Cleveland or contact your nearest Warner & Swasey Branch Office.

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WARNER & SWASEY
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IT WAS GOOD

NOW IT'S BETTER!

Again, the Oster *SIMPLIFIED* No. 601 "RAPIDUCTION" lathe steps ahead with these additional developments:

1. New 4-speed motor permits four speed changes without change of sheaves. (2-speed motor optional.)

2. Motor is mounted on oil-resistant rubber to insure smooth, quiet operation.

3. Individual ⅛ H. P. motor now operates coolant pump to provide uniform flow of lubricant, independent of spindle speeds.

4. New electrical controls have speed selector switch located conveniently for the operator.

5. Increased rigidity of the machine is insured with longer base of heavier construction.

* * *

The Oster No. 601 "RAPIDUCTION" lathe is equipped with either WORM drive or DIRECT drive, as required. Other options include automatically indexed six-position turret or plain saddle. Capacity of machine: 1½" round bar. Ask your nearest Oster dealer or write us for complete details.

OSTER "Rapiduction" LATHES

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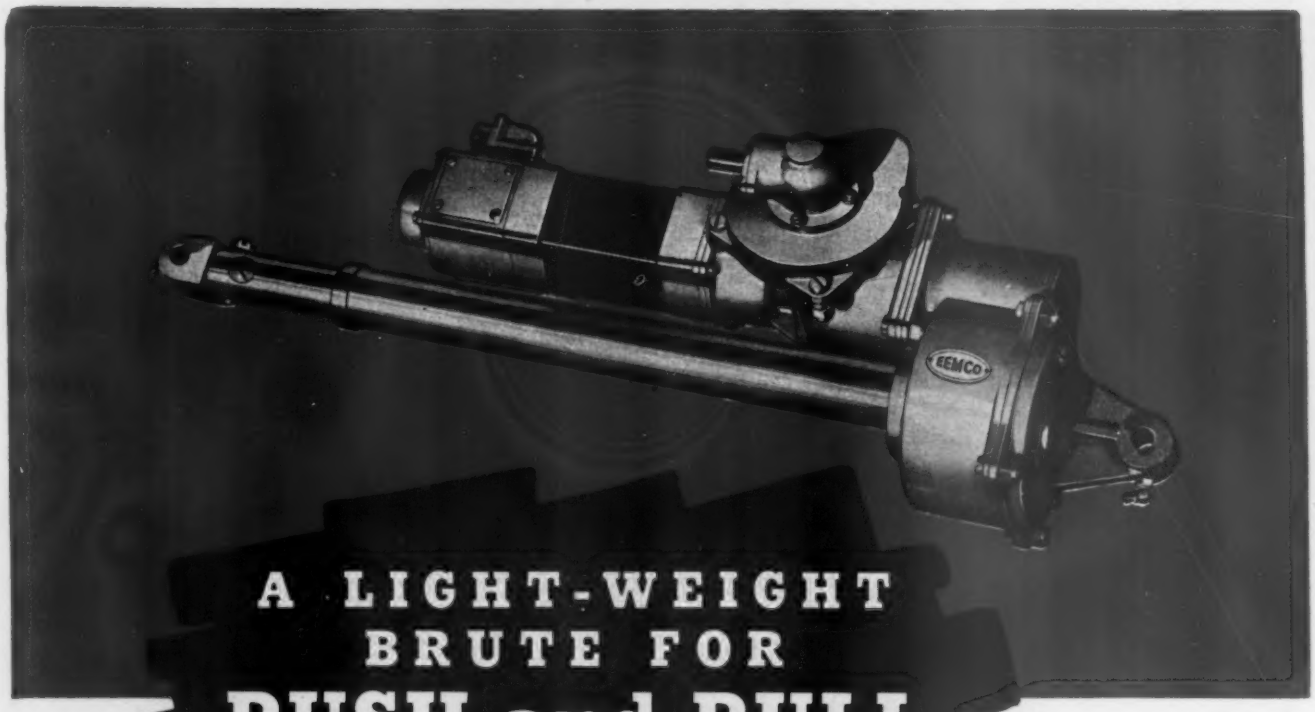


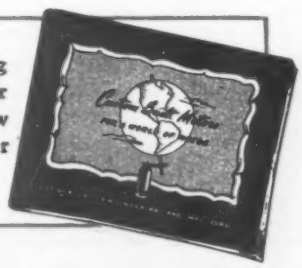
A LIGHT-WEIGHT BRUTE FOR PUSH and PULL

THIS EEMCO 22-pound electric motor-operated screw jack is designed for 8,000-pound tension and 5,000-pound compression loads . . . but will withstand up to 16,500 pounds in tension and 8,000 pounds in compression. The jack speed at average load is ⅝" per second, the length of jack travel is 11". Standby hand drive is provided. The self-locking screw jack will not jam or creep under any conditions. Gear box drive screw is composed of spur gear and planetary reduction, while mitre gear and worm reduction are employed in the standby hand drive.

MOTOR DATA: Intermittent duty type, explosion-proof, 1¼ hp, 28-volt motor with magnetic clutch and spring-loaded brake. Motor is thermally protected in case of heavy overloads and completely protected against dust and salt spray.

EEMCO's reputation for specially built electric motors is based upon the constant developmental work of its engineering, laboratory and testing staffs. Specialists in electric motor manufacture, EEMCO engineers have designed efficient motor drives for marine installations, for use in aircraft and for scores of applications in industry. EEMCO engineers will gladly study powering problems submitted, with a view to designing the exact EEMCO motor drive, gearing unit or control device for the job.

EEMCO's new catalog "Custom Built Motors for a World of Needs" is now available. Ask for your copy today.



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IMPORTANT NEWS FOR MACHINE TOOL BUYERS

We can again offer ENGINEERED REBUILT and guaranteed machine tools at a saving of 40% or more. Our stock, as always, is of the highest grade. We list below some outstanding items in our Albany Plant.

BORING MILLS

24" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

42" BULLARD New Era Vertical with one swiveling turret head and one side head. AC or DC motor drive.

66" NILES-BEMENT-POND Vertical Heavy Duty Tire Boring and turning Mill with two swiveling heads. AC or DC motor drive.

NO. 1 PUTNAM Vertical Car Wheel Boring Mill with side head for hub facing and hoist. AC or DC motor drive.

48" NILES-BEMENT-POND Car Wheel Boring Mill with hoist. AC or DC.

100" NILES-BEMENT-POND Vertical with two swiveling heads, Power Rapid Traverse. AC or DC motor drive.

120" BETTS Heavy Vertical with two swiveling heads. Power Rapid Traverse AC or DC motor drive.

120" NILES-BEMENT-POND Vertical with two swiveling heads, Power Rapid Traverse. AC or DC motor drive.

120" CINCINNATI Massive Pattern Vertical with two swiveling heads. Power Rapid Traverse. AC or DC.

No. 32. 3¼" Bar LUCAS Horizontal Table Type Boring, Drilling, and Milling Machine, Power Rapid Traverse, AC or DC motor drive.

2½" Bar CLEVELAND Horizontal Boring, Drilling and Milling Machine, Table type, all geared power feeds. AC or DC.

4½" Bar NILES-BEMENT-POND Horizontal Boring, Drilling and Milling Machine Table type, all geared power feeds, duplex control, AC or DC.

5" Bar DETRICK & HARVEY Heavy floor type horizontal boring, drilling and milling machine. AC or DC.

5½" Bar NILES-BEMENT-POND Heavy floor Type Horizontal Boring, Drilling, Milling Machine, AC or DC.

RADIAL DRILLS

4' AMERICAN Plain Triple Purpose enclosed head drill with tapping attachment, single pulley belt drive or AC or DC.

5½' AMERICAN Full Universal Triple Geared with tapping attachment. Single pulley belt drive or AC or DC.

6' CARLTON Plain 15" round column DC motor on arm, tapping attachment.

8' NILES-BEMENT-POND "Right Line" Plain with 230 volt DC motor on arm, tapping attachment.

GRINDERS

12" O. S. WALKER Single Stroke Surface Grinder with 12" dia. magnetic chuck and 7½ HP, AC or DC motor.

No. 16 BLANCHARD High Power Vertical Surface Grinder with 26" magnetic chuck and 20 HP. AC or DC.

LATHES

27"x12' AMERICAN 8 speed geared head, 96" between centers. AC or DC.

42"x36' PUTNAM Geared Head, 25' between centers. Quick change gear box. AC or DC motor drive.

48"x30' BRIDGEFORD 9 speed geared head, 20' between centers. Triple geared internal face plate drive. AC or DC motor.

48"x20' NILES-BEMENT-POND Extra Heavy Geared Head, 11'5" between centers. Power cross and angular feet to compound rest. Semi-quick change gear, taper attachment.

72"x50' (38'-6" centers) NILES-BEMENT-POND Heavy Geared Head Engine Lathe. Power cross and angular feed, two carriages, power rapid traverse.

48"x59' BRIDGEFORD Boring and Turning with 9 speed geared headstock, turning carriage with compound rest, AC or DC motor drive.

NO. 4 PUTNAM Extra Heavy Center Drive Axle Turning Lathe with two carriages AC or DC motor drive.

27" Swing 98" Centers BRIDGEFORD Plain Turning Lathe for car axles or heavy forgings, two carriages and tool rests. Single pulley belt drive or AC or DC motor drive.

42" PUTNAM Heavy Double End Car wheel lathe. Equipped with overhead hoist for loading wheels and axles.

MILLERS

No. 2 CLEVELAND Plain, table 13"x50" B & S taper No. 11. Single pulley belt drive or AC or DC motor.

NO. 3B BROWN & SHARPE Plain with double overarm table 14"x60" with 7½-HP, AC or DC motor.

NO. 4 CINCINNATI High Power Plain, Power rapid traverse, table 16½"x64". Single pulley belt drive or AC or DC.

NO. 5B BROWN & SHARPE Plain, Power rapid traverse, table 22"x81". AC or DC motor drive.

No. 3 CINCINNATI High Power Vertical Miller, single pulley drive or motor drive.

NO. 4 CINCINNATI High Power Vertical, Power rapid traverse. Table 16½"x64". Single pulley belt drive or AC or DC motor drive.

No. 6 BECKER Vertical Milling or Die Sinking Machine, Table 18"x61". Spindle B & S No. 16, AC or DC motor drive.

No. 10 NILES-BEMENT-POND Extra Heavy Vertical with 42" diameter, Power Feed rotary table, AC or DC.

24"x24"x12' INGERSOLL Horizontal Spindle Slab Miller with adjustable rail, table 24"x12'. AC or DC motor drive.

30"x30"x10' NEWTON Horizontal Spindle Slab Miller with adjustable rail, table 27"x11'. AC or DC motor drive.

24"x36"x12' INGERSOLL Planer Type side milling machine with two power feed heads on housings for side milling only.

24"x24"x12' INGERSOLL Planer Type milling machine with one head on adjustable rail and two side heads, AC or DC motor drive.

42"x26"x12' INGERSOLL Planer Type milling machine with two heads on adjustable rail and two side heads. AC or DC motor drive.

PLANERS

36"x36"x14' PUTNAM Heavy Planer with two heads on rail. 230 Volt DC reversing type planer motor & control.

38"x38"x14' OHIO Heavy with 2 heads on rail and 1 side head. 230V DC reversing type planer motor & control.

48"x48"16' NILES-BEMENT-POND Heavy with two heads on rail and two side heads. 230V DC reversing type planer motor and control.

48"x48"x24' NILES-BEMENT-POND Heavy with two heads on rail and two side heads, 230 Volt DC reversing type planer motor and control.

48"x48"x32' G. A. GRAY Spiral Drive with two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

48"x48"x24' NILES-BEMENT-POND Heavy with two heads on rail and one side head. AC motor drive through self-contained countershaft.

48"x48"x20' F. R. PATCH Heavy with two heads on rail and two side heads. 230V DC reversing type motor and control.

72"x72"x18' NILES-BEMENT-POND Heavy two heads on rail and two side heads. 230 Volt DC reversing type planer motor and control.

72"x72"x20' NILES-BEMENT-POND Extra Heavy, two heads on rail and two side heads, 230 Volt DC reversing type planer motor and control.

84" Widened To 98"x32"x42' SOUTHWARK Extra Heavy, two rail heads and two side heads. 230 Volt DC reversing type planer motor & control.

16'x10'x30' BETTS heavy, two heads on rail and two side heads, forced feed lubrication. 230 Volt DC reversing type planer motor and control.

SLOTTERS

12" SELLERS Crank Slotter, 32" circular table, AC or DC motor drive.

15" NEWTON Crank Slotter, 30" circular table, AC or DC motor drive.

15" NILES-BEMENT-POND, 30" circular table, AC or DC motor drive.

20" SELLERS Crank Slotter, 48" Circular table, AC or DC motor drive.

MISCELLANEOUS

RT40 SCHULTZE-NAUMANN Beam Shear for shearing beams and channels up to 20". AC or DC mt. dr.

5" capacity U. E. & F. Alligator Shear, AC or DC motor drive.

6" PRATT & WHITNEY Vertical Shaper with 20" rotary table.

10"x10" RASMUSSEN Production Metal Sawing Machine.

30' No. 3 HILLES JONES Plate Edge Planer.

30'x⅞" NILES-BEMENT-POND Plate Bending Rolls, Pyramid Type.

14'x½" NILES-BEMENT-POND Plate Bending Rolls, Pinching Type.

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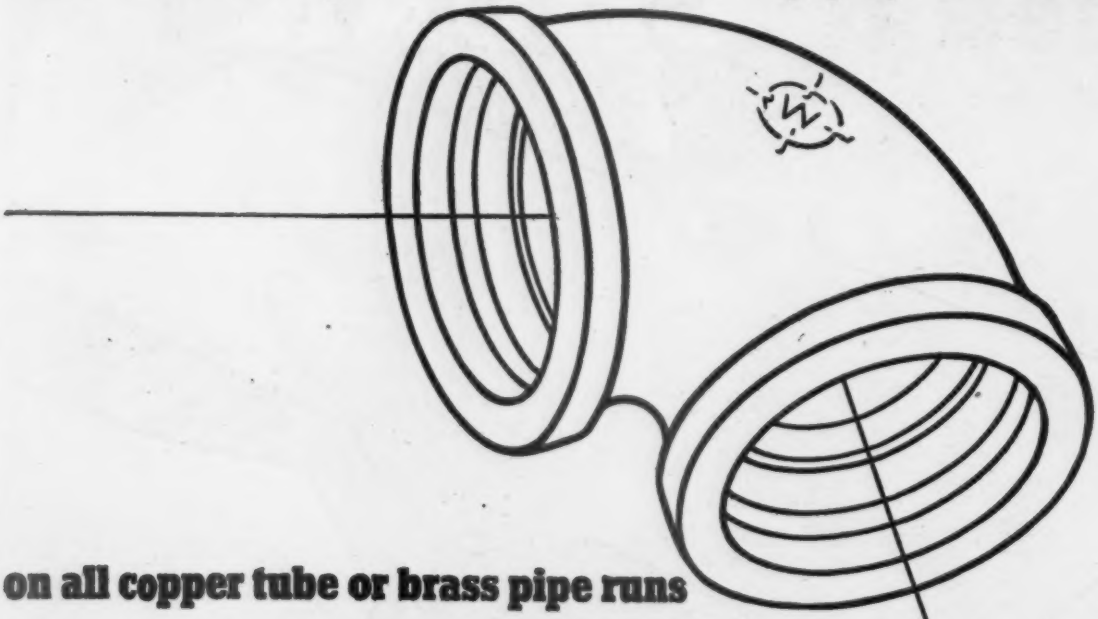

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Whenever your plans call for copper tube (iron pipe size) or brass pipe — especially in public, industrial or commercial buildings — specify patented threadless Silbraz joints made with Walseal valves, fittings and flanges. Silbraz joints effectively produce strong, lasting pipe runs.

These modern joints provide positive protection against leaks by actually becoming a part of the pipe itself. They make a "one-piece" pipe line that will not creep or pull apart under any pressure, shock or vibration that the pipe itself can withstand.

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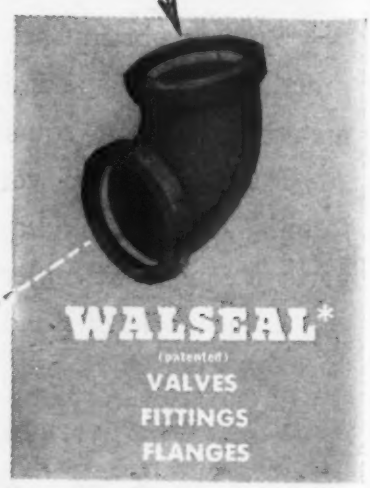
*Patented – Reg. U.S. Patent Office



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13 AWARDS TO 4 PLANTS

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No matter what your drilling problem may be, there's a CLEVELAND Twist Drill to fit the job. And in whatever size, from .0135" to 4" diameter, a CLEVELAND Twist Drill will give you *more holes per grind.* For nearly three quarters of a century the ✣ trade mark has represented uniformly high quality and dependability.

These are some of the reasons why so many railroad shops always specify CLEVELAND Twist Drills, Reamers, Screw Extractors, Arbors, Mandrels, Sockets, Mills, Counterbores, and Carbide Tipped Tools.

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will help . . .
rolling!

One basic requirement to keep your machinery rolling is correctly sharpened tools and cutters. These are quickly available when your shop is equipped with CINCINNATI No. 2 Cutter and Tool Grinders. The new features of this machine enable you to do many sharpening jobs 15% to 25% faster and to satisfy the demands of your machine set-up men when sharp cutters are needed in a hurry. ¶ The CINCINNATI Self-Contained Grinder is ideal for heavy duty work. In illustration No. 2, you will notice the gap in the table at the left of the operator—a feature which permits the grinding of parts having a diameter larger than the one to be ground, such as a locomotive piston rod assembly. The CINCINNATI Plain Self-Contained Grinders are available in 14" and 16" swings, between-center lengths up to 168". ¶ The CINCINNATI Hydro-Tel meets all requirements for a general purpose milling machine, because it handles a wide variety of milling operations and many types of work. How well it handles large parts is illustrated in photograph No. 1. The machine has ample table length and rigidity of construction to remove metal rapidly and at the same time mill to exceedingly close tolerances. Ease of operation is an outstanding feature. Because of Servo control hand traversing the table and adjusting the work and cutter to each other is just about as easy as winding your watch. CINCINNATI 28" Series Vertical Hydro-Tel Milling Machines are available in three table travels . . . 60", 96" and 120". ¶ Investigate these machines for your milling and grinding requirements. Our engineers will be glad to talk to you about their application to your work.

T MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

NE BROACHING MACHINES • CUTTER SHARPENING MACHINES

GUARD AGAINST CORROSION
when Cars are Built!

Side of car being riveted in erecting shop. Metal-to-metal contact points have been coated with NO-OX-ID before riveting.

When new cars are in production on the assembly line, they can be completely protected for the life of the car against corrosion at metal-to-metal contact points. The illustrations here show how and where NO-OX-ID is applied.

The special consistencies of NO-OX-ID formulated for use on new cars seal the metal-to-metal and metal-to-wood contact points where rust conditions are most likely to occur. Corrosion accelerators can no longer penetrate the protected areas; under-film corrosion exciters "already at work" are quickly neutralized.

NO-OX-ID is recommended for safeguarding such areas at joint and rivet lines. NO-OX-ID can also be applied to cars in the process of repair or rebuilding. It guards against corrosion accelerators wherever there is need for such protection. Start the use of NO-OX-ID in your car building assembly line before corrosion gains its first foothold. Include NO-OX-ID in your specifications.

Photos: Courtesy Pullman Standard Car Mfg. Co.

Built-In Rust Prevention for Metal-to-Metal Contacts

Workmen riveting underframe. Contact areas have been NO-OX-ID protected. Applications of NO-OX-ID guard the inaccessible places.

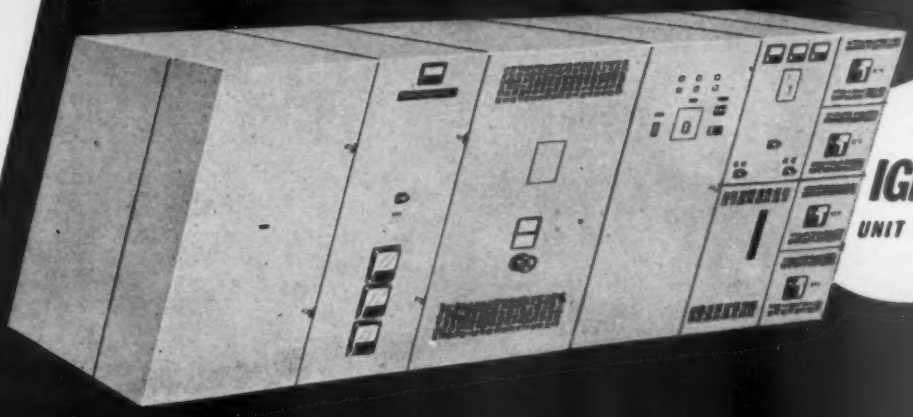
Placing car side on underframe prior to riveting. All contact points between sides and side sill are protected against corrosion by NO-OX-ID.

NO-OX-ID IRON OXIDE RUST
REG. TRADEMARK AUG. 27, 1918

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company • Dept. RM, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

Easy to install · Easier to use

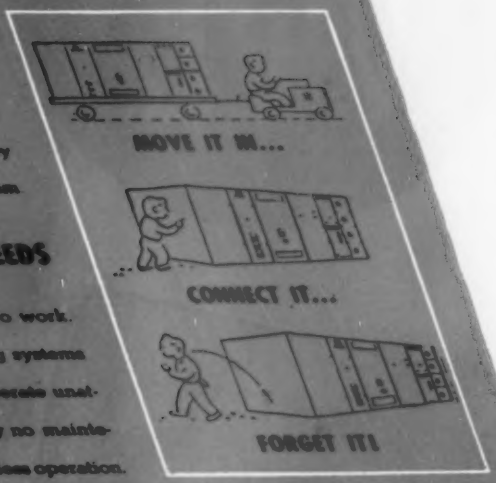


I. U. S.
IGNITRON
UNIT SUBSTATION

Requires LESS floor space per KW

The Westinghouse 1946 Model Ignitron Unit Substation, employing the ASL Transformer, requires less floor space per kw produced than any other conversion equipment.

The Ignitron Tubes, permanently evacuated and sealed at the factory, eliminate the need for vacuum maintaining equipment . . . thereby reduce maintenance to a minimum.



COMPACT · FLEXIBLE · MEETS ALL D-C POWER NEEDS

It's easy to install—on any reasonably level floor—even on balconies. No special foundation or reinforcing is required . . . Connect the control leads, power leads and water supply—and it's ready to go to work. No air ducts or ventilating systems are required . . . It can operate unattended, with practically no maintenance. Quiet, vibrationless operation.

CONSIDER ALL ADVANTAGES OF THIS IDEAL POWER UNIT

For efficient, economical power conversion
A-C to D-C at 125 Volts or higher

- High Efficiency
- Easy to Install
- No Starting inrush
- Quiet . . . no vibration
- Factory Assembled
- Low Maintenance
- No special foundation
- No special Air-Cooling
- Unattended Operation
- Instantly Available Power

Consult Westinghouse

Call your nearest Westinghouse office or write for B-3646 "POWER CONVERSION AT ITS BEST" Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Westinghouse Electronics at Work

J-10300

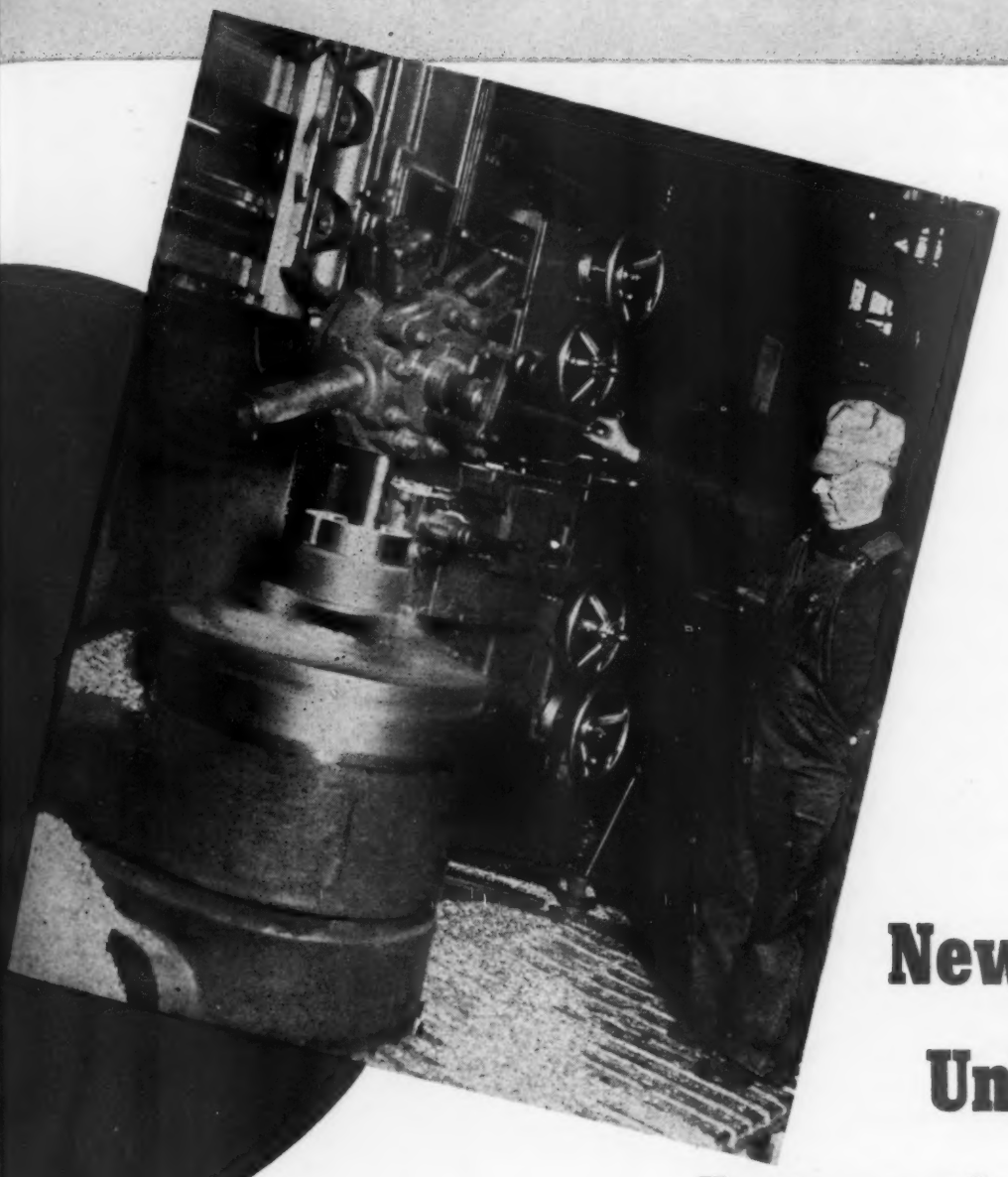
Ready for You

Bullard Cut Master V.T.L.

With a Bullard MAN-AU-TROL V.T.L. you can economically machine long runs or single units . . . can protect yourself against changes in specifications . . . can give yourself a tremendous cost advantage in competitive markets. For complete details, write today for new bulletin on the new Bullard MAN-AU-TROL V.T.L.

THE BULLARD

ur Requisitions



New Bullard Units with Automatic Controls

BULLARD engineers have always pioneered in the design and progress of Vertical Turret Lathes. Every railroad shop supervisor is familiar with their precision and economical production.

In spite of the tremendous demands from industries engaged in war production, Bullard engineers have been working on many improvements which will revolutionize present practice in the machining of many locomotive parts.

The Cut Master V.T.L. has made a big hit in a number of large shops. It possesses many features which offer unusual savings in production costs.

These features include greater power, faster speeds, greater variety of feeds, more cutting heads, simplified controls, automatic stops and many other new developments.

—And now a new addition has been made to the Bullard line—the Man-Au-Trol V.T.L. It will automatically perform any and every job (involving up to 39 functions of the main head and 39 additional functions of the side head) that a manually-operated V.T.L. can do. Further, it is equally facile as a manually operated machine.

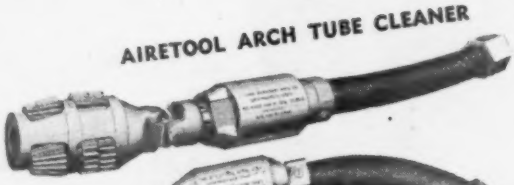
D COMPANY

CONNECTICUT

Special LOCOMOTIVE TUBE CLEANERS...

designed by AIRETOOL

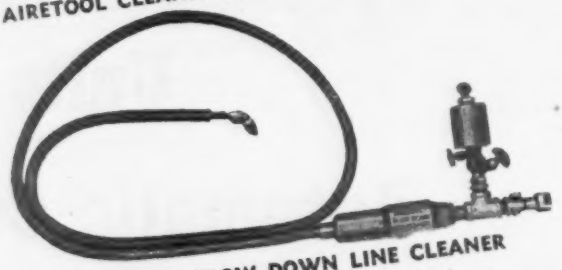
AIRETOOL ARCH TUBE CLEANER



AIRETOOL BRANCH LINE CLEANER

AIRETOOL CIRCULATING LINE CLEANER

AIRETOOL CLEANER FOR NICHOLSON SYPHONS



AIRETOOL BLOW DOWN LINE CLEANER

There is an Airetool cleaner especially designed to meet the requirements of any locomotive tube cleaning job.

The New Form Cutter Heads of these cleaners eliminate tendency of cutters to track and damage tubes. An exclusive Airetool feature — the periphery of the cutter is milled to divide sections of the circumference into teeth of various pitch, which prevents cutter finding same spot in a tube wall during each revolution.

Airetool Cleaners are driven by a motor that develops 28% more power. This increased power is due to Balanced Rotor which eliminates friction and expensive thrust mechanisms so that all power is directed against load — and Power Seal which produces constant torque at low speeds, eliminates dead centers, and prevents motor stalling when loaded down to 50 rpm.

Airetool Tube Expanders

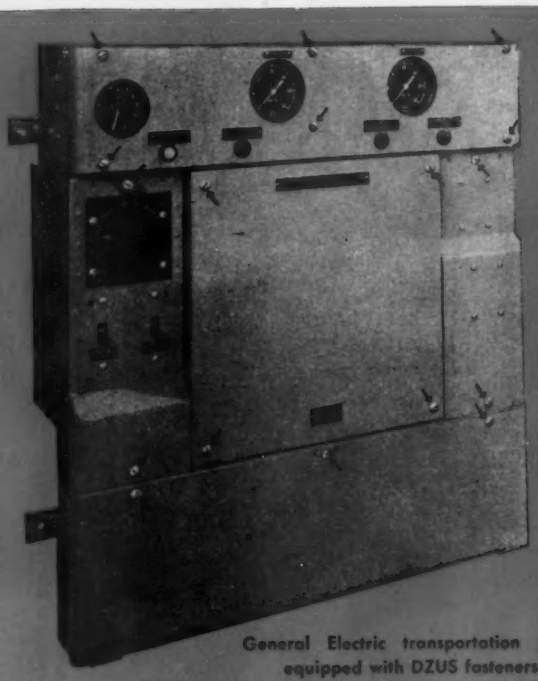
Airetool Tube Expanders are made of heat treated alloy steel and a maximum amount of tortional strength is provided in the mandrel to resist the extreme twisting action set up in rolling operation. Proper density is provided in the rolls for severe compression without flaking. The cage material has wear and thrust resisting elements. Uniform hardness of each moving part permits the tool to run cooler and last longer.

Expander for Huron Wash Out Plug Bushings

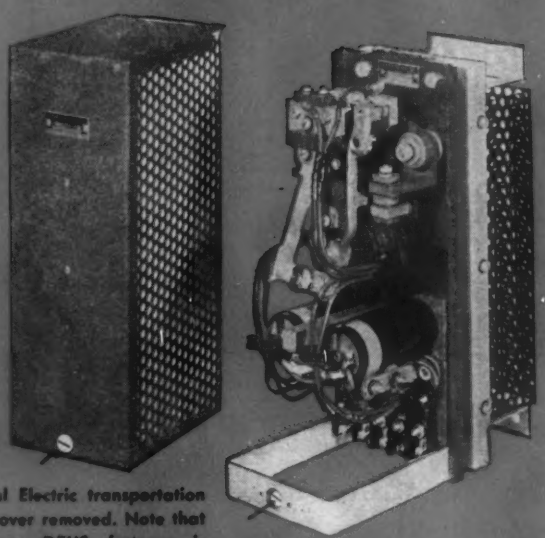
Helpful Bulletins Free— Write for Your Copy Today.

AIRETOOL MANUFACTURING COMPANY

510 AIRETOOL & YOST-SUPERIOR FACTORY BLDG., SPRINGFIELD, OHIO



General Electric transportation panel equipped with DZUS fasteners



General Electric transportation relay cover removed. Note that only one DZUS fastener is necessary

One wing-type fastener holds the cover of this transportation relay unit

QUICK ACCESS *with* DZUS*

SELF-LOCKING FASTENERS

Yes, you get quick, positive action with Dzus fasteners on removable covers, panels, access and inspection doors and other hinged or removable parts. Just a quarter turn to open or close. They are rugged and vibration-proof. They may be permanently attached so no parts are lost — or they may be removable. They are easy to install too, and lend themselves to modern mass production methods. In addition its simple, quick operation saves valuable time of mechanics in inspection and maintenance.

If you have a fastening problem on a hinged or removable part, consider the outstanding advantages of Dzus spiral cam fasteners. They are available in various sizes, head styles and materials to meet your requirements. Send for our catalog. It contains detailed directions, specifications and many illustrated applications.

*The word Dzus is the registered trade mark of the Dzus Fastener Co., Inc.

DZUS FASTENER CO., INC.

BABYLON NEW YORK

IN CANADA: RAILWAY AND POWER ENGINEERING CORP., LTD.

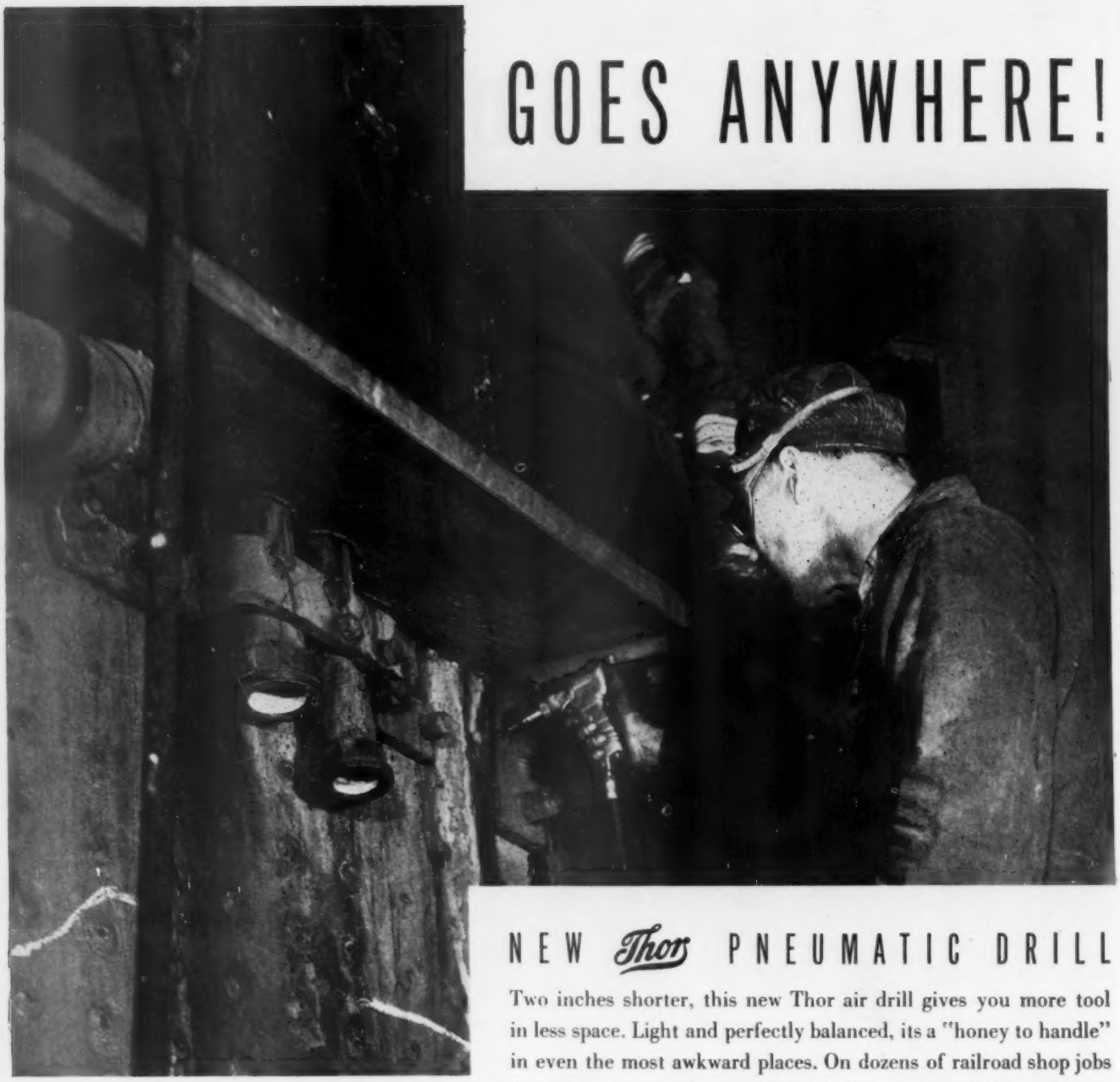
Oval head stud

Grommet

Spring

Cut-away view of complete assembly

GOES ANYWHERE!



No. 210G air drill 3/16" capacity, Pistol Grip, 5 3/4" long, 2 5/16 lbs. For drilling tell-tale holes and many other car and engine shop jobs.

NEW *Thor* PNEUMATIC DRILL

Two inches shorter, this new Thor air drill gives you more tool in less space. Light and perfectly balanced, its a "honey to handle" in even the most awkward places. On dozens of railroad shop jobs its compact power means more and better work . . . with less fatigue.

Design and construction improvements like this keep Thor pneumatic and electric tools in the lead for performance that keeps costs down and production *up*. Write today for Catalog 52-B.

INDEPENDENT PNEUMATIC TOOL COMPANY

600 W. Jackson Boulevard, Chicago 6, Illinois

Birmingham Boston Buffalo Cleveland Detroit Los Angeles Milwaukee New York Philadelphia
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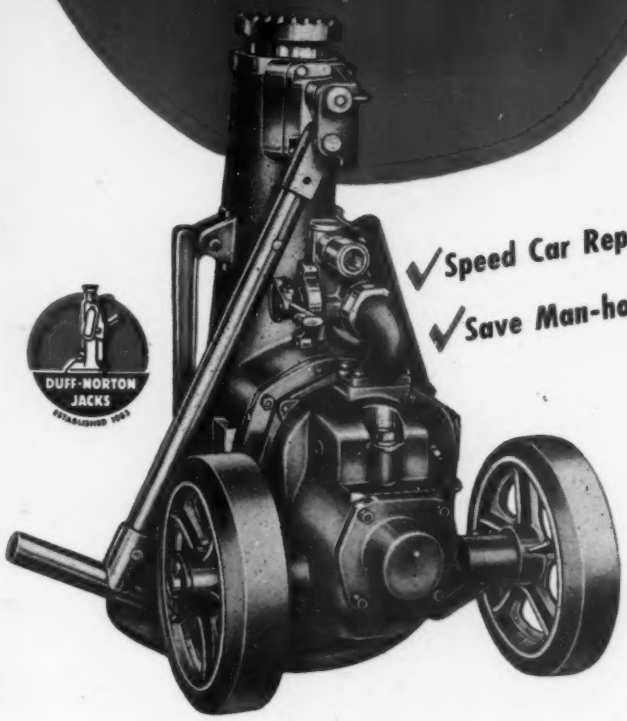
Thor PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

Duff-Norton

Air Motor Operated

Power Jacks



✓Speed Car Repairs

✓Save Man-hours

Results of long shop service definitely prove the advantages of Duff-Norton Air Motor Operated Power Jacks, bearing out the claims for speeded-up repair work and man-hours saved.

The complete line of Duff-Norton Air Motor Jacks includes 5 types in capacities from 20 to 100 tons for every type of roundhouse and car shop work. Write for descriptive literature.

HERE'S WHAT THE EDITORS OF

Railway Mechanical Engineer

HAVE TO SAY...

Jack-Handle Days...

According to the best estimates of time-study men on one of our major railroad systems, two 50-ton air-operated jacks installed at an average freight car repair point today will have paid for themselves by savings in labor costs alone within 15 months.

That's Right! Paid for themselves within 15 months!

Even more important are the man-hours saved for use on other work and the increased speed of car release from repair points. Experience has shown that about 800 hours of mechanics' or helpers' time has been saved through such an installation during the course of a single year.

800 hours saved!

At an exceptionally busy shop point such an installation, made in 1937, was paid for within the first four months after the jacks were delivered.

Within the first 4 months

Various committees of the Car Department Officers' Association and other groups have urged consistently that more attention be paid in the expenditure of mechanical department funds to the needs of car repair points. Whether the men on the locomotive side have been more articulate in expressing their needs isn't clear but generally it appears that a new shaper for the backshop or a lathe for an enginehouse is more likely to be approved than two jacks for the car yard. Their relative cost is small, the rate of amortization on the investment high but at all too many points the jack-handle rather than the air-line lifts cars.

What is true of car jacks is true of many other items of equipment in use at car repair points. A thorough study on any system of the possibilities of employing modern tools and devices would enable car department officers to approach management intelligently with requests for appropriations. The accumulated labor cost and car-release delay time represented by jack-handle days should convince even a stubborn management in times much harder financially than the present.

"An editorial appearing in a recent issue of Railway Mechanical Engineer."

THE DUFF-NORTON MANUFACTURING CO., Pittsburgh, Pennsylvania

CANADIAN PLANT: COATICOOK, QUE. • REPRESENTATIVES IN PRINCIPAL CITIES

A Comfortably Warm Locomotive Shop

Does that seem too Good to be True?

The traditional railway shop has always been notoriously hard to heat—at least, compared with the average machine shop, let us say. Too cold in some spots, too hot in others, its discomforts were too often taken for granted. But modern railroad men have been studying shops heated by Wing Revolving Unit heaters, and have found here the answer. *Revolving* discharge outlets give thorough, uniform coverage, circulating under and around obstructions, into far corners and repair pits, giving a sensation of fresh, live, invigorating warmth to workers. And in Summer, with the steam turned off and the fans on, these same revolving outlets keep the air in constant, gentle motion, bringing relief and comfort on the hottest days.

Both views in Locomotive Shop of Northern Pacific Railway Co., Livingston, Montana.

Write for Bulletin: "Wing Revolving Unit Heaters"

L. J. Wing Mfg. Co. 154 W. 14th St., New York 11, N.Y.

Factories in Newark, N. J. and Montreal, Canada

Wing REVOLVING UNIT HEATERS

No matter what Paint Vehicle is needed . . .

- SYNTHETIC RESINS
- NATURAL RESINS
- MODIFIED SYNTHETICS
- DRYING OILS

RED LEAD'S WIDE COMPATIBILITY

makes its Extra Rust Protection Available

The fact that Red Lead is generally accepted throughout industry as the standard metal protective paint indicates two things:

1. *That it must be widely adaptable to various service conditions.*
2. *That it must offer something* EXTRA *in the way of rust prevention.*

Red Lead's versatility is due principally to its compatability with the wide range of vehicles needed to answer present-day service demands. It can be used with practically every type of paint vehicle on the market—synthetic resins, natural resins, drying oils, and combinations of these.

Thus, paints for any metal protective purpose can be formulated with Red Lead. Since almost any paint vehicle can be used with Red Lead, a broad range of drying requirements can be met—anything from the normal drying primer used on structural steel to the quick-drying paint essential to present-day production schedules.

Why Red Lead means Extra Rust Protection

Red Lead has the property of counteracting acid conditions, recognized as accelerators of rust. In the presence of various acids, Red Lead forms insoluble lead salts at the approximate rate at which the acids are supplied.

This is true whether the acid originates from acid-forming environments, such as gas, smoke and moisture in the atmosphere, or from the decomposition of the vehicle. Thus, a rust-inhibiting condition is maintained with a Red Lead paint.

Red Lead also forms an adherent protective shield which prevents electrochemical action, another prime cause of rusting.

Specify RED LEAD for All Metal Protective Paints

The value of Red Lead as a rust preventive is most fully realized in a metal paint where it is the only pigment used. However, its rust-resistant properties are so pronounced that it also improves any multiple pigment paint.

No matter what price you pay, you'll get a better paint for surface protection of metal, if it contains Red Lead.

Write for New Booklet—"Red Lead in Corrosion Resistant Paints" is an up-to-date, authoritative guide for those responsible for specifying and formulating paint for structural iron and steel. It describes in detail the scientific reasons why Red Lead gives superior protection. It also includes typical specification formulas—ranging from Red Lead-Linseed Oil paints to Red Lead-Mixed Pigment-Varnish types. If you haven't received your copy, address nearest branch listed below.

* * *

All types of metal protective paints are constantly being tested at National Lead's many proving grounds. The benefit of our extensive experience with paints for both underwater and atmospheric use is available through our technical staff.

NATIONAL LEAD COMPANY: New York 6, Buffalo 3, Chicago 80, Cincinnati 3, Cleveland 13, St. Louis 1, San Francisco 10, Boston 6 (National-Boston Lead Co.); Pittsburgh 30 (National Lead & Oil Co. of Penna.); Philadelphia 7 (John T. Lewis & Bros. Co.); Charleston, W. Va. (Evans Lead Division).

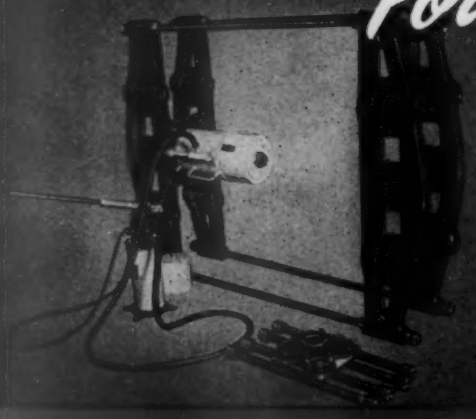
DUTCH BOY RED LEAD

2 unusual hydraulic PRESSES

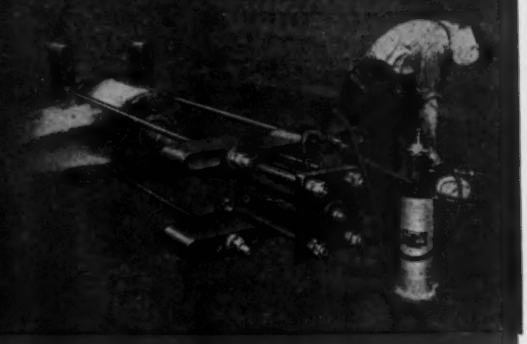
that can save you Time, Labor and Trouble

on 101 maintenance, service and special jobs.

RODGERS **Portable** UNIVERSAL PRESS

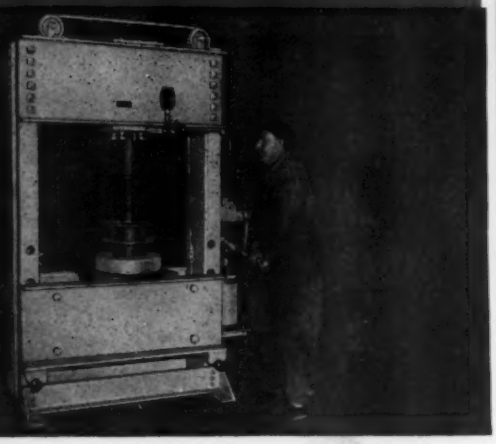


Left: Here is a Rodgers 200 ton Universal with back plate and rods shown beside it. At right is a Rodgers Universal mounted around a large pitman to pull the shaft. Real power—easy to use!



RODGERS **Flexible** SHOP PRESS

Left: A Rodgers 100 ton Shop Press—study its simplicity — note pins below bed for increasing opening —hand pump mounted on side. Right: A bushing is easily pressed into a sheave with a few strokes of the hand pump.



STOP and think of all the uses you can find for these versatile Rodgers Presses — pulling gears, pinions and wheels; pressing shafts, bushings and pins, squeezing, clamping and jacking operations —wherever you need 50 to 200 tons of easily-applied hydraulic power.

The Rodgers Universal is a unique portable unit for field or shop service. It is used on a stand as an ordinary press, on its side or flat and is easily assembled around equipment for special operations. Rodgers Hydraulic Hand Pump or Power Pump supplies power.

A Rodgers Shop Press is a flexible unit with a bed that is easily raised or lowered to accommodate various size work. Cylinder may be adjusted across entire width of bed. Rodgers Hand Pump or Power Pump furnishes pressure.

If you have equipment to service you can save yourself hours of time and labor with a Rodgers—they often pay for themselves on a tough job or two. Write for *all* the details. It will be profitable.

Send for this new catalog . . .

It will give you complete information on Rodgers Hydraulic Presses. No obligation, of course. Write today.

Rodgers Hydraulic, Inc.

hydraulic power equipment

Shop Presses

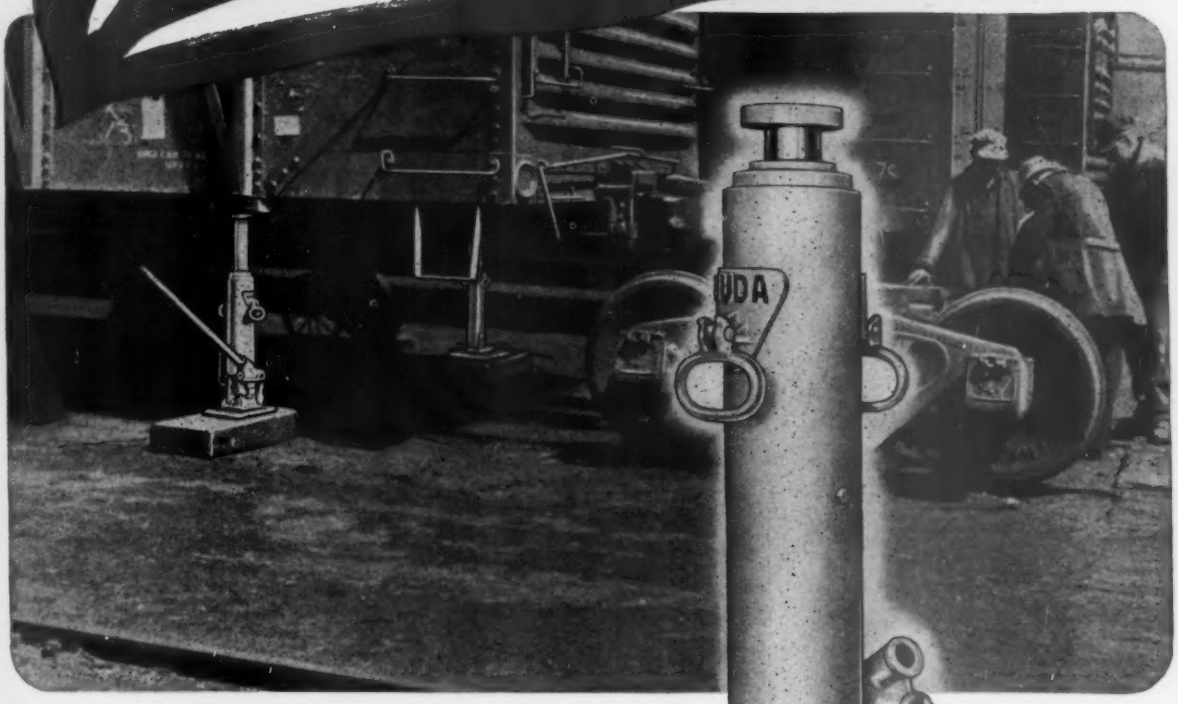
Crawler-Track Presses

7459 Walker St., St. Louis Park, Minneapolis 16, Minn.

Power Pump Units

Portable Presses

Tower OF STRENGTH



BUDA
Model 25-B-28
Two-Speed
Hydraulic
Car Jack

BUDA

Two-Speed Hydraulic CAR JACK

The BUDA Two-Speed Hydraulic Car Jack . . . a powerful, up-to-the-minute tool designed for the heaviest lifting service.

The features incorporated in the BUDA Model 25-B-28 make it the fastest, safest and most dependable jack of its type. Write or wire today for a complete description of the BUDA Two-Speed Hydraulic Car Jack.

Chore Boys

2215-SB All-Purpose Jacks

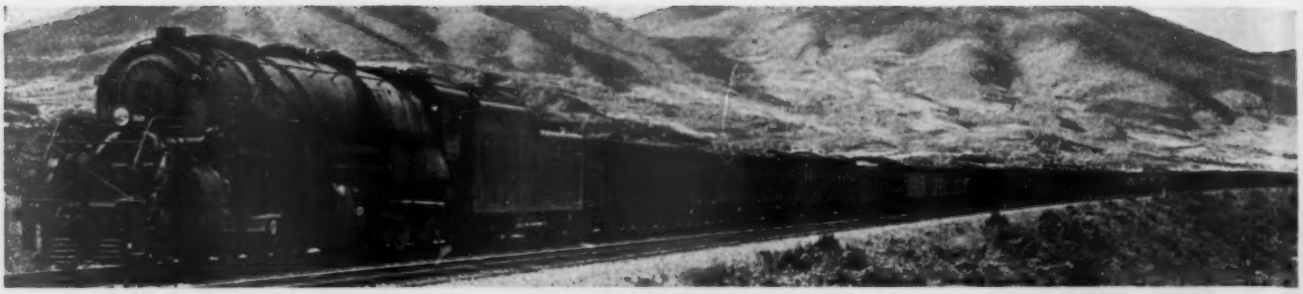
ARMY E NAVY

BUDA

Gas, Gasoline and Diesel Engines

Nozzle Testers

15407 Commercial Avenue
HARVEY (Chicago Suburb) **ILLINOIS**



A Superior Service VALVE

FOR EVERY RAILROAD NEED

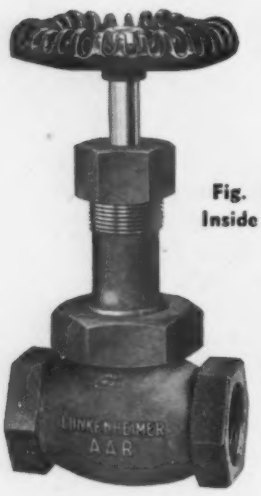


Fig. 1890
Inside Screw

On locomotives, in roundhouses and shops, a wide variety of Lunkenheimer products meets every railroad service requirement—valves of bronze, iron, steel; cocks, fittings, unions, air nozzles, boiler mountings and lubricating devices.

These *quality* valves and other products, widely used throughout the industry, are well known for their superior dependability, long service, low-cost maintenance, and assurance of maximum safety. They are made to A.A.R. specifications.

THE LUNKENHEIMER CO., CINCINNATI 14, OHIO, U.S.A.
Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7.
Export Department: 318-322 Hudson St., New York 13, N. Y.

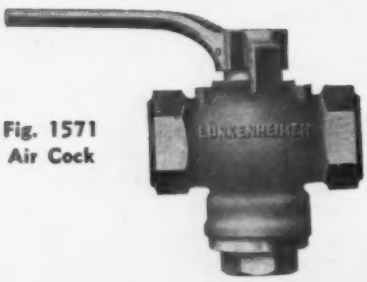


Fig. 1571
Air Cock

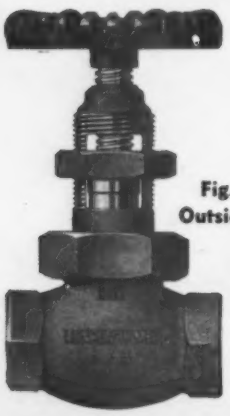


Fig. 1896
Outside Screw

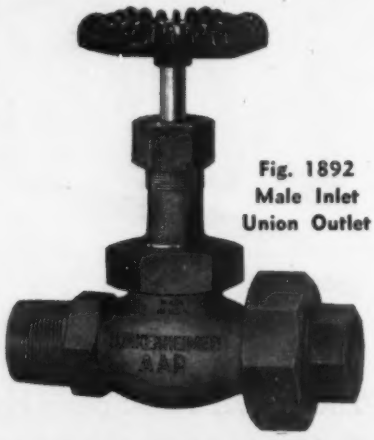


Fig. 1892
Male Inlet
Union Outlet

LUNKENHEIMER VALVES

Now! REAMING AND BOLTING is Safe and Easy

Reaming in structural steel work has its hazards because the men often work high above ground with narrow steelwork as their only support.

Reaming with an air-operated Impact Wrench is safe and easy. The wrench is light enough to be used in all positions. The torque on the operator is so slight that in most cases the dead handle is not used. The steel worker can easily operate this tool with one hand. When finished, he removes the reamer and uses the same wrench to bolt up.

The rotary impact action of the I-R Impact Wrench is ideal for reaming and produces a clean hole free from chatter marks. Reamers can be easily fitted to the wrench chuck by simply slipping one or two nuts, of the size used on the job, over the reamer shank, welding them fast and cutting off any projection.

Some contractors have reported that by using the Impact Wrench to do both operations, reaming and bolting-up time has been cut in half.

COMPRESSORS
TURBO BLOWERS
OIL AND GAS ENGINES
CENTRIFUGAL PUMPS
CONDENSERS
AIR TOOLS
ROCK DRILLS

Ingersoll-Rand 8-782

11 BROADWAY, NEW YORK 4, N. Y.

L&S
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L&S
MEET ALL

L & S LATHES

R.R. SHOP REQUIREMENTS

A TOUR through the leading railroad shops is the most convincing evidence that LODGE & SHIPLEY LATHES are meeting all the expectations of the machine tool committees.

You will find them in the tool rooms, back shops and large engine-terminals turning out the every day run of locomotive parts from large axles down to small bushings.

Some of the most recent railroad shop installations are illustrated on the opposite page. At the top left, is an 18" L & S Lathe in West Virginia turning out crosshead pins—close-up at upper right is another 18" unit working on wrist pins in a large shop in Colorado. In the center is a L & S Gap Lathe truing up a locomotive piston rod in a Vermont Shop —lower left, a L & S is at work on a bronze bushing in a large engine terminal in Ohio—lower right is a big 30" x 144" L & S Lathe finishing a locomotive axle in a large shop also, located in Ohio.

L & S engineers are always ready to help you with your shop requirements.

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LATHES

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CINCINNATI, 25, OHIO, U. S. A.

L & S LATHES

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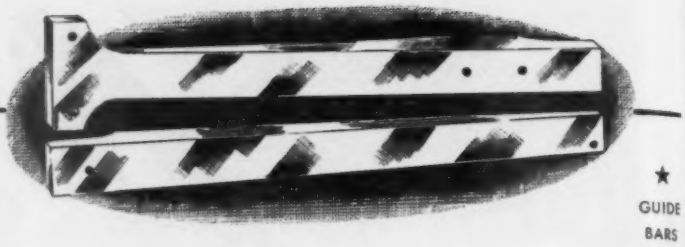

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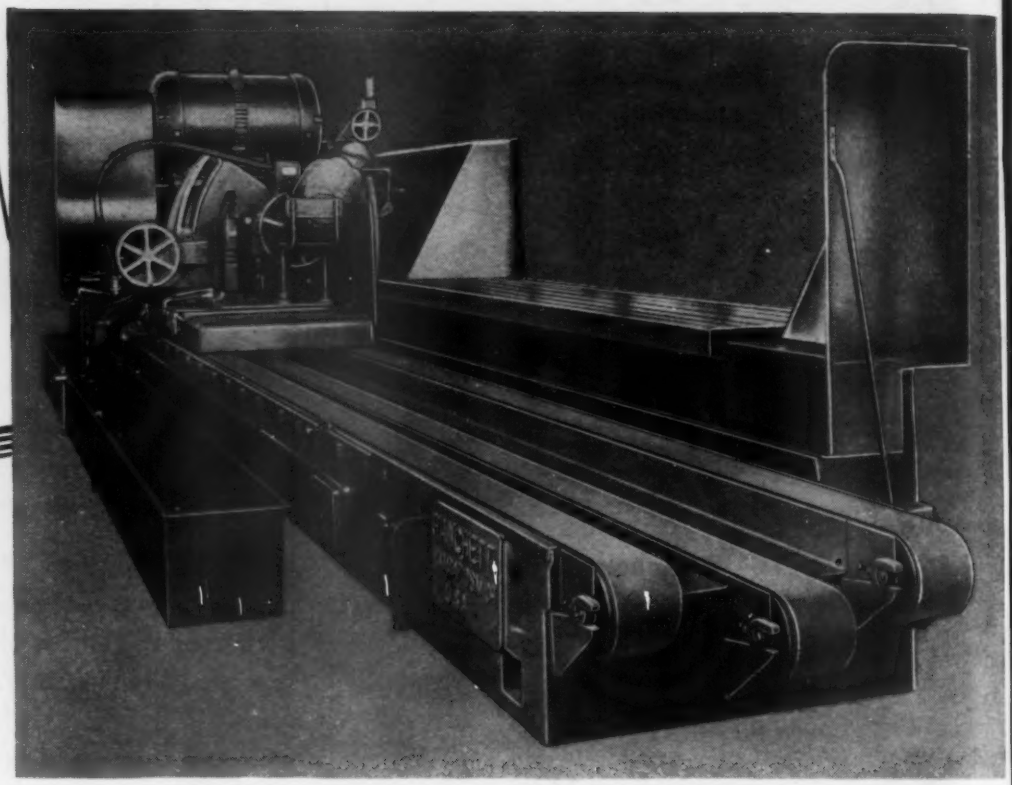

Armor plate, locomot've guide bars, nozzle stands, and other heavy pieces are precision ground and re-finished on top, bottom, sides and ends on Hanchett UK grinder.

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BIG RAPIDS, MICHIGAN U.S.A.

QUESTION:

When oil costs are too high, what's the simplest way to cut them?

ANSWER: STOP DISCARDING USED OIL. RESTORE IT AND RE-USE IT.

QUESTION: *Can This Be Done Successfully—and Economically?*

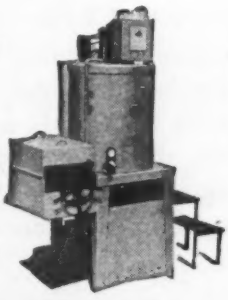
ANSWER: *Yes! Dirty or contaminated oil can be so thoroughly restored that you can use it in just the same place and manner as you used the new oil. And restoration costs only a few cents.*

QUESTION: *What Kinds of Oil Can Be Restored?*

ANSWER: *Practically any kind used in your industry. You can restore used Diesel engine and other lubricating oils; hydraulic cylinder oils; transformer oils; oils for metal cutting—and can use them over and over again.*

QUESTION: *What Steps Are Necessary to Restore Used Oil?*

ANSWER: *For fully satisfactory restoration, non-lubricating volatiles should be removed by slow heating, and solids and asphaltic materials by contact with earth and filtration. Acidity should be reduced to new oil values.*



QUESTION: *Isn't This a Complicated Process?*

ANSWER: *No! The entire restoration is carried out in a single unit—the YM Oil Refiner.* No presettling or pretreatment *of the oil is needed; no special skill is needed to operate; only low-cost, readily available materials are required.*

QUESTION: *How Can I Get More Information on the YM Method of Restoring Oil?*

ANSWER: *Just mail the coupon below for preliminary information. Or write us about your oil restoration requirements—we'll be glad to discuss them with you.*

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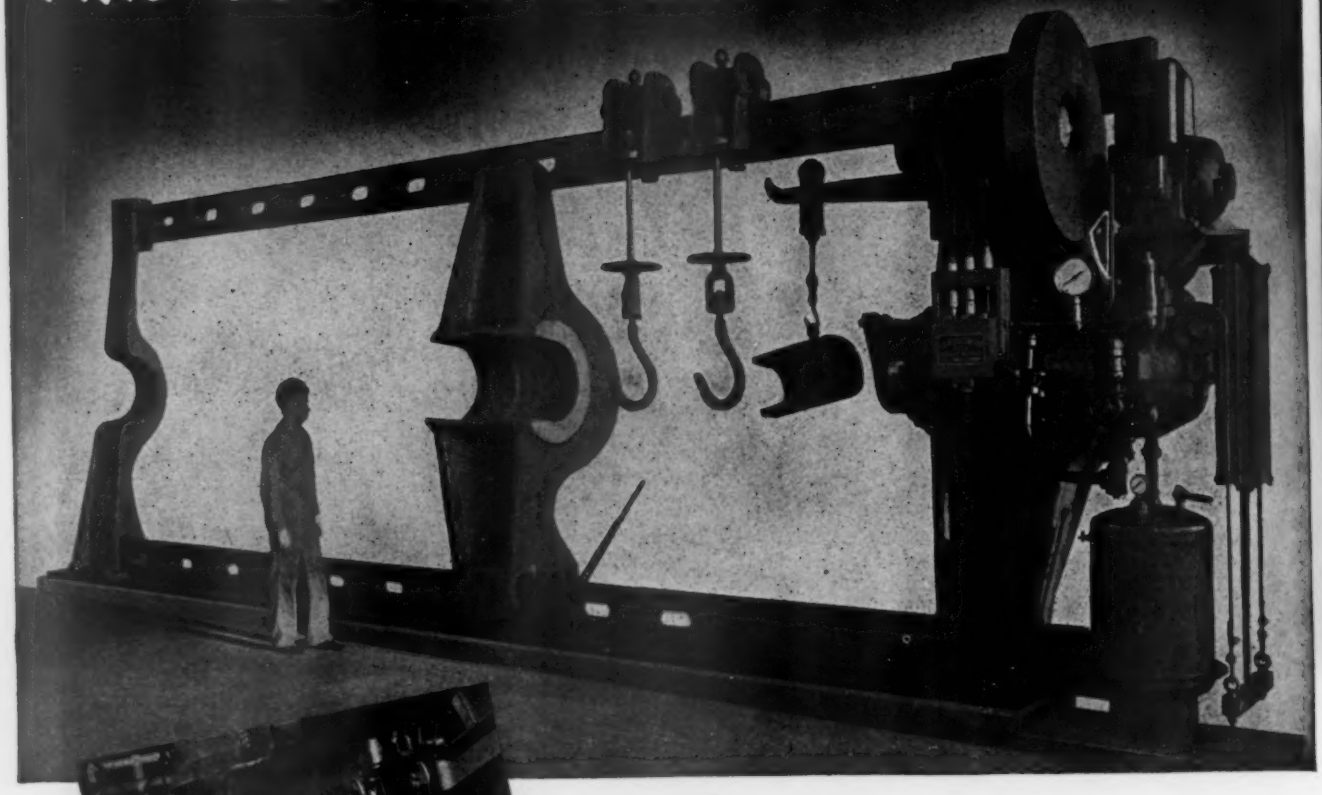

...Speeds WHEEL-and-AXLE Maintenance!

One way to keep rolling stock rolling is to speed up repairs. This takes modern equipment. R. D. Wood design ingenuity in hydraulic equipment makes possible the quick, economical performance of vital work in railway shops.

This Wood hydraulic wheel press is an outstanding example. Requires no pit and has self-contained pumping unit and controls. A pneumatic pull-back device eliminates counterweights and gives a faster rate of ram return than is obtainable on ballast-weighted devices. It always pays to consult Wood engineers on hydraulic equipment requirements.

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Low pressure . . . 100 "

RAM: Diameter 16", Stroke 26"

CLEARANCE: Between bars . . . . . 96"
To resistance post . . . 20"

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Major castings of normalized O.H. steel and generous use of Meehanite castings including end post, cylinder, ram, plunger heads, etc.

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For Fast Economical Production of Jaw Forgings

Ajax Forging Machines are of exceptional value in the production of a wide range of jaw forgings, particularly so on the ends of long rods.

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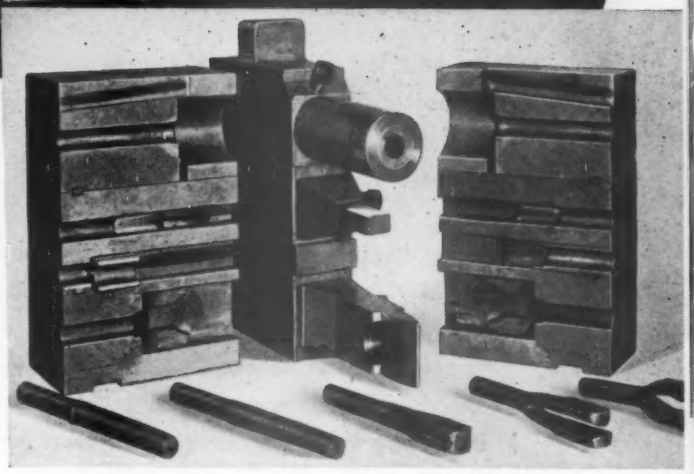
Where the size of the machine is ample and the jaw design suitable, it can be completely forged in the upsetter in dies similar to those illustrated. After gathering, the stock is split by the action of the die slide by closing with suitable splitting knives carried in the gripper die. After that the jaw is brought to finished form by a final upsetting operation.



Jaw Forging Dies with Progressive Forging Operations.

As a third method, where production does not warrant outlay for the somewhat complex dies with slitting knives or where the jaw is large in relation to the size of the forging machine, the slitting operation can be performed on an Ajax Hot Sawing and Burring Machine or with a cutting torch.

Write for Bulletin No. 65-B

THE AJAX MANUFACTURING COMPANY
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THE EDITOR'S DESK

THINK DEEPLY—AND ACT WISELY

"Americans seem to have lost the quality of indignation." This is the conclusion of George E. Sokolski in discussing the New York dock strike in the New York Evening Sun. The principal sufferers from the strike, he pointed out, are our soldiers in Europe and the starving peoples dependent upon our country for relief.

If we have lost this quality of indignation, what will become of our democracy? Is it doomed? And if it is, does that need to concern us as railway and railway supply men?

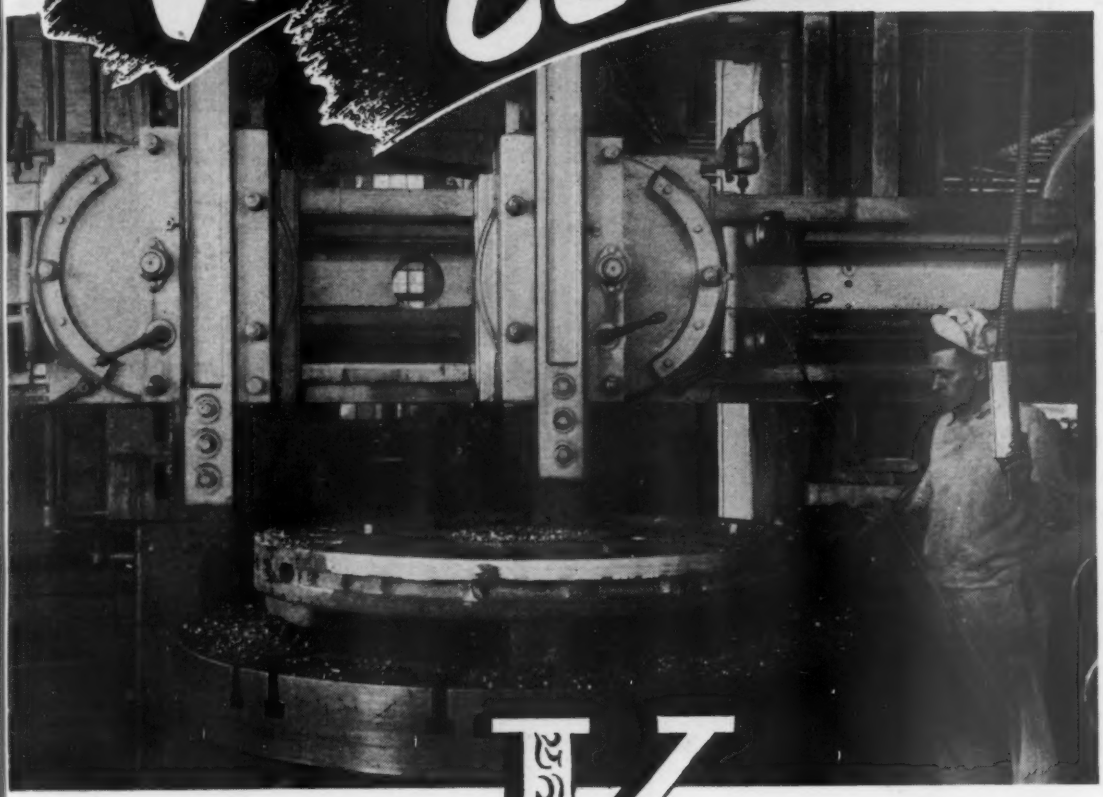
The late Lord Josiah Stamp, British economist, in speaking on Essential Characteristics of Democracy at the Congress on Education for Democracy, held at Teachers College, Columbia University, in 1939, said that the best concept of democracy he had found was that expressed by Winthrop W. Aldrich. Here it is:

"The essence of the democratic ideal is first of all the inviolability of the fundamental rights of the individual so that each individual may be free to develop the best that is in him. To make this liberty effective, we must have opportunity to do those things we wish to do, *provided they are not harmful to others.* (The italics are ours.) We must have freedom of speech, of conscience, and of thought. We must have tolerance for all races, all creeds, and all minority interests. We must recognize the equality of all citizens before the law. This does not mean a simple and crude equalitarianism, because that is impossible, human nature and capabilities being what they are, but it does mean equality of opportunity for all."

The loss by the American public of the "quality of indignation" at being pushed around by minority pressure groups is weakening and eroding the foundation on which to build a sound business prosperity. If the structure of business prosperity falls, "equality of opportunity for all" become words devoid of all practical meaning in the railway and railway supply fields just as in every other field of industry or commercial activity. Surely we want to preserve our democracy, but it can't be done by lapsing into a spirit of indifference and hopelessness.

Roy V. Wright

WHEEL CENTERS



the King Way

ALL KING Double Column Boring Mills from 52" to 144" Swing are available with or without Side Head.

On many jobs the use of three cutting heads will naturally reduce production costs. Take for example the above illustrated 84" KING Mill which was recently installed in a large railway shop. The job is a 66" wheel center. One column head is machining the outside diameter — the other column head is facing the hub and the side head is facing the rim. All three operations performed simultaneously. Boring of the axle fit will also be handled by the column head facing the hub.

There must be a very definite reason why so many railroads are specifying the "KING Way" for their boring and turning problems. Why not investigate? You can have single column machines in 30" - 36" and 42" sizes.

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BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

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Founded in 1832 as the American Rail-Road Journal

NOVEMBER, 1945

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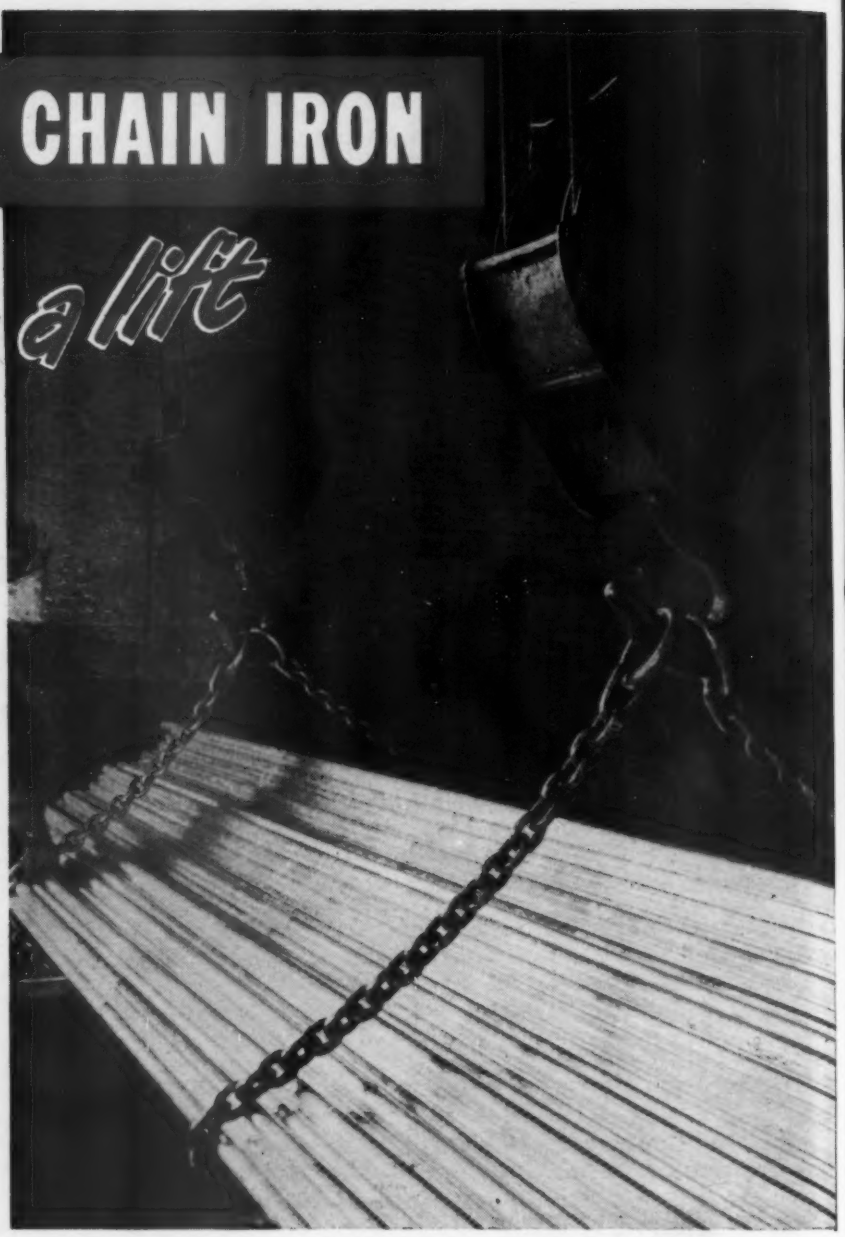
Let BYERS CHAIN IRON give you a lift



Here's some news that will be welcome to every man responsible for maintaining sling chains, and to every blacksmith who forges the links. Byers Chain Iron is now available for repair work, ready to add a new safety factor in material handling, and new ease and speed in chain recondition operations.

The biggest contribution that Byers Chain Iron makes is in the advance warning of failure it gives when overstressed. Links that have been loaded beyond their capacity "neck-out" so that the weakness is apparent in visual inspection, and the chain can be withdrawn for repair before failure actually occurs. The savings that this one unusual property has made in accidents avoided and equipment damage averted can hardly be overestimated.

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Byers Chain Iron has an additional advantage when materials must be handled into and out of process tanks containing aggressive liquids, or where the atmosphere is unusually corrosive. The Chain Iron has unusual resistance to corrosion from a variety of commonly used process materials.

The properties that make Byers Chain Iron so desirable for material handling come directly from its unique composition. Tiny fibers of glass-like silicate slag are threaded through a main body of high-purity iron. This gives a structure something like that of a stranded wire cable, highly resistive to shocks and recurrent stresses. The fibers serve also to halt and disperse corrosive attack, and help anchor the initial protective film, which shields the underlying metal.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

NOTE: BYERS CHAIN IRON in a range of sizes suitable for repair work is available for immediate delivery from A. Milne & Co. Just contact their nearest office in New York, Boston, Chicago, Pittsburgh, Philadelphia, or Washington.

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ELECTRIC FURNACE ALLOY STEELS · OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

Conventions-in-Print

It has been the custom when the four Co-ordinated Mechanical Associations hold their annual conventions, to have one general session, including the entire group, at which an inspiring and instructive address is made by an outstanding personage in the railway world.

This Convention-in-Print, therefore, includes such a feature, but in the form of four relatively short, snappy messages from men who rank high in railway affairs in this most trying period in railway history— Col. J. Monroe Johnson, who has done such a fine and striking job as director of the Office of Defense Transportation; Russell G. Henley, quiet, but sound thinking and effective, who is chairman of the Mechanical Division, Association of American Railroads; and two comparatively young, but aggressive railroad chief executives who have demonstrated special ability in the field of leadership—Robert E. Woodruff, president of the Erie, in the East; and Fred G. Gurley, president of the Atchison, Topeka & Santa Fe, in the West.

Their messages sound keynotes for girding up for action by the four Co-ordinated Mechanical Associations and the resumption of their normal operations, including regular conventions in the fall of 1946. There is a large and important place in the railway field for these organizations. They fill a real need, and the words of encouragement and the practical messages from these leaders should do much to inspire them to still greater efforts in the days which lie before us, when the railroads will face bitter competition. A maximum of service, at minimum cost to the public, can only be achieved by the greatest possible efficiency in maintenance and operation of the equipment and facilities. These mechanical associations, conducted on a volunteer and free-will basis, have given a splendid account of themselves in the past, which, let us confidently hope, will be even bettered in the future.

The reports of the associations, which follow the introductory statements, speak for themselves, particularly in light of the fact that the committees have had to work under rather discouraging conditions and with little or no opportunity for conferences. The reports for the Master Boiler Makers' Association are incomplete and the missing ones will appear in later issues of the *Railway Mechanical Engineer* as they are received. On the whole, the record for the quality of the reports and the meeting of schedules for their completion, is exceptionally good, considering the circumstances. They presage well for the success of the program makers and the committees which will be charged with preparing the material for the conventions next year.

A Job Well Done— But Not Finished

A MESSAGE FROM

COL. J. MONROE JOHNSON

DIRECTOR OF O. D. T.

For four years your organizations have voluntarily given up your annual gatherings in order to conserve wartime transportation, a most commendable and patriotic action. By means of the "Convention-in-Print" you have been able to have the benefit of official reports and valuable technical papers. Advertising in the Convention-in-Print issue of the *Railway Mechanical Engineer* has served as a substitute for the exhibits usually displayed at a convention headquarters.

But all this has by no means been a satisfactory substitute for the personal contacts and free interchange of opinion in a regular convention. I realize that this is particularly valuable in the case of the four Allied Railroad Mechanical Associations—The Master Boiler Makers' Association, Railway Fuel & Travelling Engineers Association, Car Department Officers Association, and the Locomotive Maintenance Officers Association. The association in these organizations is of very great benefit to their members, and, of course, to the railroads with which the individual members are connected.

Railway transport is going through a most critical transition period. The war is over, but there are millions of soldiers whose travel homeward presents a formidable passenger traffic problem. For the rest of the year our fighting men will be reaching our ports at the approximate rate of 900,000 a month. And the normal peak season for freight is now at hand.

None know better than the members of your associations with what difficulty the railroads have managed to carry the enormous extra burdens of war traffic, while the war itself has made it impossible to secure more than a minimum of new equipment. The war has also reduced the ranks of railroad workers, with more than 300,000 men called into the armed services and their places to be filled by inexperienced men.

The members of your groups have played a leading part in keeping the railroads running during this emergency, with its unprecedented strain on all transportation facilities. You have had to use the utmost ingenuity in patching up equipment, in making repairs again and again where normal practice would call for scrapping old rolling stock and replacing it with new. You have had to learn new ways to make the most of low-grade fuels, and to shift from one type of coal to another. I do not consider myself competent to discuss all the individual technical problems you have encountered and conquered, but I understand the general situation well enough to realize that without you we could not have kept the railroads functioning during the war.

The railroads, having gone through four years of war, must now solve a difficult post-war problem. It will be many months before the carriers will be able to replace the equipment worn out or made obsolescent during the war years. And yet during these months the railroads must be on their toes to secure their share of the country's transportation business. The competition of other forms of transportation will be greatly intensified because of wartime developments.

This means continued exercise of that ingenuity you of the Mechanical Associations displayed during the war. And many of you have learned new ways of doing things that will make for better railroading in days to come. You will be joined by railroad workers who have been acquiring valuable experience in the emergencies of war railroading in strange and far-off lands and under the most trying circumstances.

There can be no let-down as we move from wartime to peacetime operation of the railroads. It is not merely a matter of financial success for the railroad companies. There is a far more important objective. You must play your part in keeping the vast industrial and commercial machine of America running on high gear, in transporting the products of an expanding economy. You and I, all of us, must show the world that the American spirit that built the world's greatest military machine in a few months, can find in peacetime the inspiration for no less memorable achievements in the post-war remaking of the world.

COLONEL J. MONROE JOHNSON, director, Office of Defense Transportation, has made an enviable record for himself in the World War. Our nation was deeply shocked and greatly concerned when death removed Joseph B. Eastman from a key position in a time of crisis. Colonel Johnson, a civil engineer by training and a veteran of the First World War, in which he served as an officer of the 117th Engineer Regiment of the Rainbow Division, was drafted to succeed Mr. Eastman. Brilliant and fearless, he accepted the responsibility and has done a really magnificent job in helping to make the best possible use of our American transportation system for both war and civilian needs, and under almost impossible conditions. And he has fought hard—he is a South Carolinian and knows how to express himself—to secure support for the railroads, which have had to bear the brunt of the load.

RUSSELL G. HENLEY, chairman of the Mechanical Division, A.A.R., and general superintendent motive power of the Norfolk & Western, has demonstrated unusual ability as a leader of men and the builder of a strong and highly regarded mechanical department organization. This is not to be wondered at when we consider his thorough practical training, starting as a roundhouse mechanic, and his fine technical ability, which is flavored by a generous component of sound common sense. Keenly appreciative of its importance from a business and operating point of view, he has established unique records for the utilization of locomotives and rolling stock. Modest and soft spoken, he weighs his words carefully, and his suggestions as to where special effort should be made by the mechanical associations at this time are worthy of most careful and favorable consideration.

Suggestions for 1946 Programs

FROM

R. G. HENLEY

CHAIRMAN, MECHANICAL DIVISION, A. A. R.

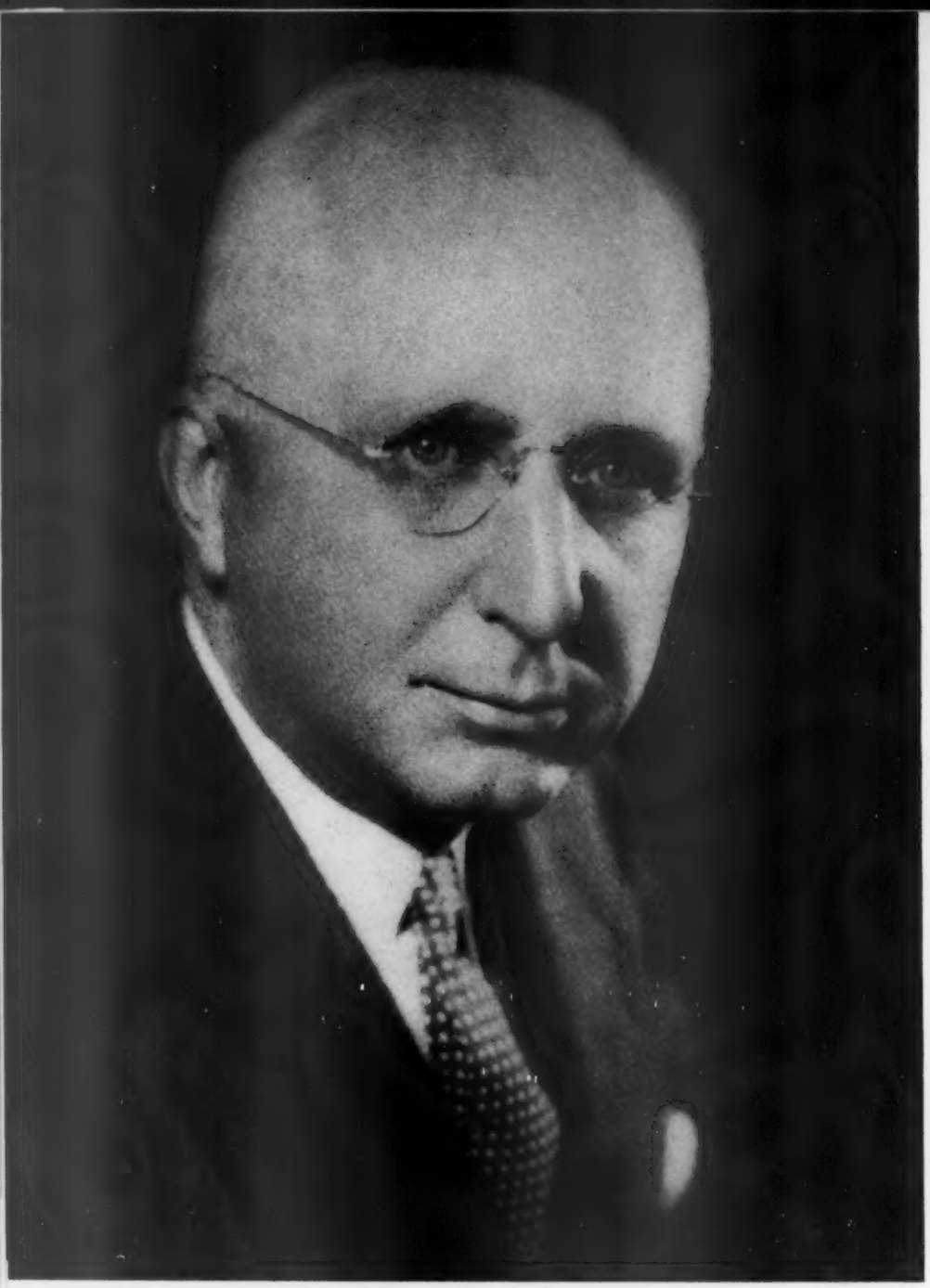
For the fourth consecutive year the Co-ordinated Mechanical Associations will hold a "Convention-in-Print." The record volume of freight and passenger traffic handled by the American railroads during the war emergency, the prohibitions against conventions, and the necessity of supervisors remaining on the job have made this action necessary.

You are to be commended for your enthusiasm in carrying on the work of your associations in spite of extreme difficulties and severe handicaps. The papers in this "Convention-in-Print" will assist in keeping your Associations alive and will add much to the progress of railroad science.

Every effort should be made to avoid duplication of work and over-lapping of subjects. The importance of team work as against individual effort cannot be too greatly stressed. There should be some means for each of the four Co-ordinated Associations to keep closely in touch, and to seek the advice of the others in matters in which they are all interested. Progressive, or what some might term radical ideas, should be thoroughly discussed and after careful consideration routed through the Mechanical Division to such research groups that are properly equipped to further develop them.

At the present time it is my thought that the Co-ordinated Mechanical Associations should direct their efforts in the channel of better maintenance, and improvements in operation and servicing of both the existing as well as the modern equipment that will soon be in operation on the railroads. There is no better way you can be of assistance and aid to the railroads than to maintain the equipment at the highest standard, and in condition for the greatest availability, thereby rendering the very best service to our shippers and patrons.

That can be done best by all of the Associations working together intelligently and cooperatively. I hope this will be kept uppermost in the minds of all and the Co-ordinated Mechanical Associations will give thoughtful consideration to this in their preparation for and at their meetings in the Fall of 1946.



ROBERT E. WOODRUFF has worked his way from a section hand to the top of the Erie Railroad. He knows railroading from A to Z and has exercised rare judgment in taking advantage of technological improvements and applying sound business principles to railroad operation and administration. A keen student of men, with an engineering training as a background, he early recognized that the strength and effectiveness of an organization rests in the human element. Probably no other railway chief executive has given as much time and critical study to the selection, training, development and promotion of men—and it has borne rich fruit. He has been a consistent inspirer and supporter of groups of men who gather to study their common problems and train, by actual practice in their meetings, to develop and make their personalities more effective.

Supervisors Must Be Good Teachers

AN EXCELLENT SUGGESTION FROM

R. E. WOODRUFF

PRESIDENT, ERIE RAILROAD

"If you want a job well done, do it yourself."
"It's easier to do it myself than to show someone else."

EXPRESSIONS such as these were common in the railroad industry a few years ago. Many old timers thoroughly believed in them. We have all seen top management doing things that division officers should do: the Master Mechanic taking a job away from a Foreman and bossing it himself—a Foreman doing a bit of particular work, with four or five men standing around watching him—all of this because supervision had not been trained to teach.

In all my experience I have never known a single good natural teacher—without training. Some of us have thought we were good teachers, but we were not reliable, sometimes doing a good job and sometimes a poor one.

All of this has been changed by sound teaching methods, formulated along the lines of Job Instructor Training—the so-called "Sure-Fire Method" of teaching a little at a time, showing, telling, and repeating back. It is so simple that any man of ordinary intelligence can learn how to use this useful tool.

Many are not yet acquainted with it. It is one of the great things that have come out of war production. Now, instead of a Foreman doing a "ticklish" job, he can train his men to do it in the correct and safe way, and he himself can have the pride of knowing that he has accomplished something worth while.

We now have hundreds of men studying and applying Job Instructor Training, and I am convinced that any ordinary man can become a good teacher through learning the principles and correct practice under a competent instructor.

[Articles on how the Erie Railroad applied the Job Instructor Training methods appeared in the Railway Mechanical Engineer, August, 1943, page 349, and Railway Age, January 16, 1943, page 199.—EDITOR.]

Important Functions of Mechanical Associations

AN APPRAISAL BY

FRED G. GURLEY

PRESIDENT, ATCHISON, TOPEKA & SANTE FE

THE cost of maintaining cars and locomotives on Class I railroads in this country amounted to $962,241,672 during the first seven months of 1945, the highest of any similar period on record and an increase of 4.9 per cent over 1944, when the total reached $917,391,185. Undoubtedly, the efficient expenditure of such large sums is a primary responsibility of railway managements, and executive officers must exercise their wide experience and best judgment in establishing policies and general practices designed to make every dollar spent for equipment maintenance produce maximum results.

In the army, a general and his staff may know how to win a war, but unless they get that information down through individual company officers, sergeants and corporals to the men in the ranks, the war is lost! Similarly, in railway service, particularly equipment maintenance work, competent, well-informed master mechanics, shop superintendents, general foremen, department supervisors and gang leaders, both car and locomotive, are a vital necessity. Without them to instruct, supervise and, if you will, inspire the men who work under them, many man-hours will be lost, materials wasted and the best-laid plans of managements largely nullified.

Ever since the turn of the century, a number of associations of railway mechanical department supervisors have played an important part in the self-improvement of individual members and hence increased the value of services rendered to their respective railroads. It is not too much to say that the Railway Fuel & Traveling Engineers' Association, an amalgamation of two groups, deserves a large share of the credit for railway accomplishments in fuel economy and improved engine service. The annual year books of this association constitute a library of useful information on these two associated subjects.

The Car Department Officers' Association, through its progenitors dating back to 1901, initially was formed to expedite the interchange of freight equipment and subsequently broadened its scope to include other major problems which confront car supervisors in connection with the construction, maintenance and use of all types of car equipment. Considering the vast expenditures of labor and materials annually for this purpose, any association such as the C. D. O. A. which promotes the interchange of ideas among car supervisors and tends to increase their knowledge and capacity is serving a constructive purpose.

Similarly, the Locomotive Maintenance Officers' Association, which is an outgrowth of an earlier association of railway general foremen, offers as yet largely unexplored possibilities for the self training and improvement of supervisors in the large and highly important field of railway shops and enginehouses. One important subdivision of this field is being ably covered by the Master Boiler Makers' Association, a small but aggressive and forward-looking group whose annual proceedings present exceptionally valuable detailed information regarding the work of this craft.

The four groups mentioned were organized as the Coordinated Mechanical Associations prior to the war, with joint meeting dates and programs designed to avoid duplication or overlap and supplement the work of the A. A. R. Mechanical Division. Individual members comprise railway supervisors sufficiently interested in improved conditions to join the associations on a purely voluntary basis, give their time to committee work and, in many instances, attend meetings at their own expense.

Owing to the lapse of four years without annual meetings, due to war conditions, the affairs of all four of these associations are at a relatively low ebb and it is, therefore, gratifying to note tentative plans for a joint meeting next fall, possibly accompanied by an exhibit of improved railway materials and devices. Based on past accomplishments and future possibilities, the Coordinated Mechanical Associations deserve not only the general approval, but the active encouragement, support and help of railway managements.

FRED G. GURLEY, president of the Santa Fe, and one of our youngest railroad presidents, essentially quiet and modest in temperament, has a colorful and strong personality with a keen sense of humor. An exceptional organizer and administrator, he is cautious and conservative, as required by his responsible position, yet definitely forward-looking. His enthusiastic idealism is tempered by sound judgment and years of operating experience. Studious, ambitious and determined, he keeps one eye on the budget and the other on the operation of the railroad. A stickler for details and efficiency, he forms opinions slowly on the basis of a thorough study of the facts, and then sticks to his decisions once agreed upon. He inspires co-operation and teamwork in his official family and is unstinting in praise of unusually good work by subordinates.

Car Department Officers' Association

Limited reports prepared in 1945—Stimulus of annual meeting needed to keep association functioning

LIKE other groups of mechanical department supervisors, the Car Department Officers' Association has continued to function during 1945, but with activities and interest greatly curtailed due to necessary restrictions, not only of annual meetings but executive and standing committee meetings. Generally speaking, it has been difficult for car men to devote any personal time to committee work owing to the pressure of urgent duties in keeping car equipment, both freight and passenger, in condition to move during the war emergency. Many loyal officers of the C.D.O.A. feel that without the stimulus of an annual meeting in 1946, and particularly the expressed approval and support of higher railway managements, it will be almost impossible for the association to continue to function at all, let alone reach the constructive performance level of which it is capable.

The affairs of the association have been conducted during the last year under the leadership of acting president and chairman of the executive committee the late A. J. Krueger,* general superintendent car department, New York, Chicago & St. Louis, Cleveland, Ohio.

Among other deterrents to progress of the C.D.O.A. has been the absence of so many of its members in military service, and few have had a more interesting experience than President F. E. Cheshire, who received a commission in World War I and left his position as assistant superintendent, car department, Missouri Pacific, to reenter the army in April, 1942, as a major of engineers. He was assigned shortly thereafter to transportation duty in London, returned to Washington as chief, Overseas Liaison, Office Chief of Transportation and, early in 1943, was promoted to lieutenant-colonel, Transportation Corps, in command of Camp Millard, Ohio, a technical training center for railway men. In March, 1944, he was activated and commanded the 709th Railway Grand Division which was sent overseas and served in France, Belgium and Luxemburg. He was promoted to colonel, Transportation Corps, returned to this country early in 1945 and resumed civilian status last July as master mechanic for the Missouri Pacific at Osawatomie, Kan.

At a meeting of the C.D.O.A. Executive Committee on September 26, presided over by Chairman Krueger, Colonel Cheshire also resumed his duties as president of the association and will be assisted by present officers, who will continue to function until new ones are elected at the next annual meeting. Full committee reports of the C.D.O.A. will not be available for publication until issuance of the 1945 Year Book. The *Railway Mechanical Engineer* presents abstracts of some of these reports and of addresses by the officers in the following pages:

Address by President Cheshire

The coveted status of a civilian permits me to assume again the duties incumbent upon your president. It is indeed a privilege to be back among you and have the opportunity to sit down with the officers, and other members of the General Committee, to review the field of activity and jointly to high-light those problems demanding the qualified attention so essential to continued and substantial progress.

I would be remiss in a privileged duty did I not commend your other officers, for the competent way in which they have carried on through the war years. This has been accomplished at no little personal sacrifice, but nevertheless with characteristic devotion in maintaining a body of car men in association, to meet the challenge of new problems in post-war transportation.

The great handicap under which your association labors is that which has been imposed by the war since 1941, namely, no annual meetings. More recently, the inability to hold even committee meetings has adversely affected subject development.

Were it not for the help of *Railway Mechanical Engineer,* again made available as a "Convention in Print" issue for November, we would indeed be mute, except for our own published formal proceedings. It is largely through the cooperation of the railroad technical press and the active assistance and encouragement of members of its editorial staff that the spark of association activity has been preserved.

Just now, there is every indication and every reason to believe that rail transportation stands in the early days of a decade of unequalled challenge. Precedent must give way to qualified initiative. Traditional design must undergo critical review impelled by the force of unparalleled competition. Established practices need a clinical examination and rigorous treatment.

To do these things as rapidly and as well as they must be done will require the enthusiastic, concerted efforts of the best men in the field. This, will require meetings, discussions, conferences, conventions and action. Accomplishment will require development, assignment, direction, energetic service and some personal sacrifice. It is with confidence I assure you that your officers are bent upon providing the executive and administrative effort requisite to a dynamic program of improvement in rolling-stock maintenance and maintenance practices. However, acceptable progress on such a program will be achieved only by individual activity of the membership. To those receiving committee assignments likewise comes the individual challenge to contribute by interested activity. Without this, the very premise of the organization is denied—association. Association of ideas; association of activities!

The committee reports here included are limited by all of the interferences imposed by the European and Japanese wars and the distraction incident to their prosecution. Your officers are preparing for an early start in 1946 on a program of challenging activities and many of you will be named to various committees. The progress of each such committee will be measured by the varying degree of individual activity. Those who are not named to committees are urged to contribute to individual committees their experiences, ideas and recommendations. By doing this, the committee reports will be finally representative of the best collective experience.

Be assured we look forward to a climax of the 1946 activities in a convention meeting in the early fall of 1946. Your officers intend that it be one of unequalled contribution to the art of rolling-stock maintenance and maintenance practices. Your individual interest and activity is necessary to that end.

Address by Vice-President D. J. Sheehan

Victory, Success and Accomplishment: Since the last annual *Railway Mechanical Engineer,* "Convention in Print" we have, in this country, tasted victory; for which we are all thankful and proud. We, as members of the

* Reference to the sudden death of Mr. Krueger on October 13 appears on page 568 of this issue.

Car Department Officers' Association rightfully feel that we have been successsful in our particular part which has been vital in achieving that victory. We have accomplished a great deal, and at the present time we must realize that in order to reap the benefits of victory and successs, we must continue in our efforts towards accomplishment.

Last year, I appealed to the membership to assist in giving the officers and chairmen of the committees the benefit of their individual thought on the subjects that they would like to have discussed and the discussion of which would help in the more effective performance of car department work. The response during the year has been encouraging, even though the volume of the response has not been large. I would continue to urge the members of this association to offer suggestions for subjects which might be beneficial to them and to other members of the association. A great many new problems are being introduced in car departments of the railroads of this country at the present time and they are problems which many of us are endeavoring to solve. It is my hope and desire that, when we meet at our next convention, we will have an opportunity to discuss and propose solutions for many of these problems.

My attention has recently been called to a method of making repairs to light bad-order cars, which is being tried on several railroads and which is known as the "spot repair system." On some railroads a practice is being inaugurated to set up a repair facility which will cover all work done on light bad-order cars in a space which can be occupied by as few as 12 cars at one time. The cars are moved by means of a car mover onto these spots where all the work is completed, the cars then moving off this spot ready for handling into the classification yard. This method appears to be most interesting in that it affords the possibility of segregating all workmen, materials, tools and supervision in a small area. It is hoped that this subject will be handled by committee and presented at the next annual meeting.

A great many freight-car repair tracks are making use of mobile equipment such as cranes, tractors, lift trucks, trailers, etc. The handling, care, maintenance and upkeep of this equipment presents a new problem to car-department officers. It is hoped that one of your committees will, during the next year, make a study of various means of solving this problem and that, at our next meeting, details will be presented.

With modern trends and the necessity for increased efficiency in handling materials on repair tracks, there are many innovations in material control and deliveries. This subject will also receive consideration during the ensuing year.

My attention has recently been called to a new and unique method of handling unmounted wheels. A comprehensive study of this subject and development of the advantages and limitations of various methods of handling car wheels, both mounted and unmounted, would be most helpful.

My purpose in mentioning these few items is to appeal to our membership to offer their services and their experience on subjects of this kind to your Executive Committee and the committees to whom these subjects will be assigned. It is difficult for the Executive Committee to know which of its members have had actual experience with some of these problems and we would most heartily welcome the thoughts, experiences and suggestions of any members who are familiar not only with the problems stated above but any other problems which confront the car department officer in his daily tasks.

May I offer the sincere appreciation of the officers of this association for the assistance that has been given them during the last year by individual members and

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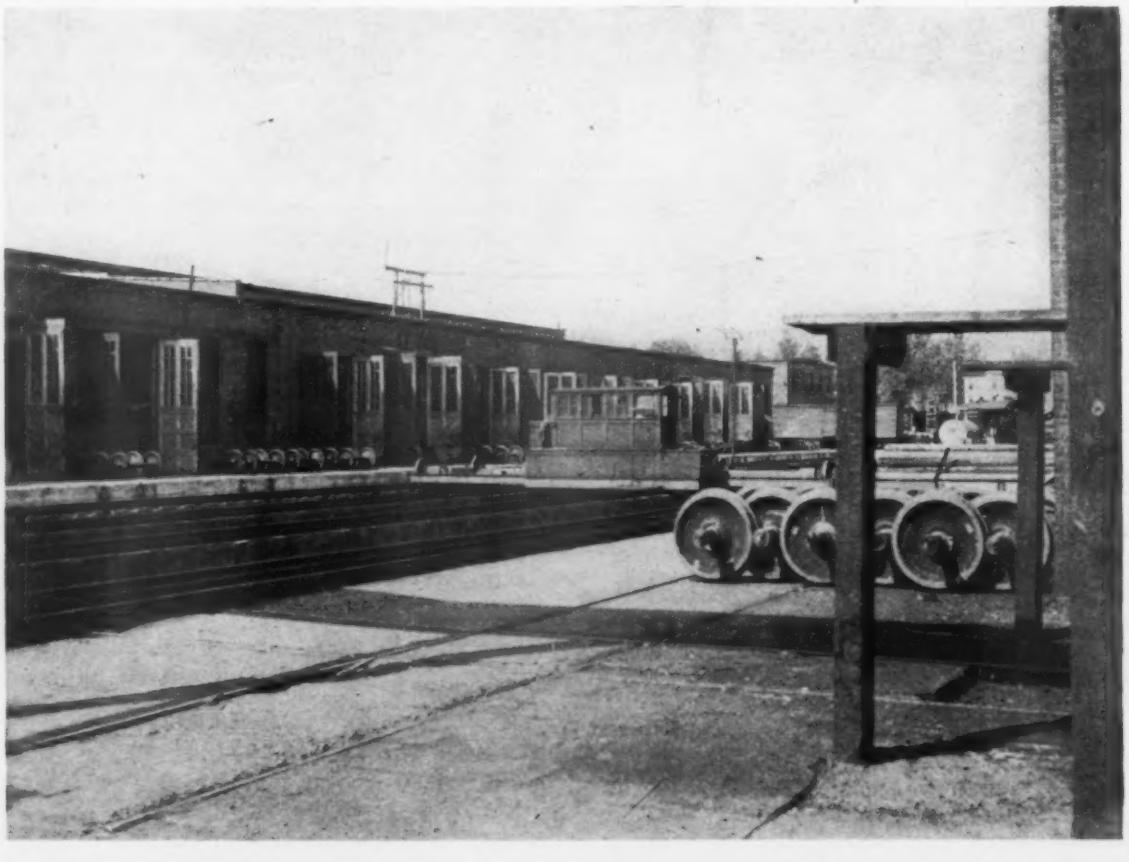

Lt. Col. F. E. Cheshire

A. J. Krueger

Officers
Car Department Officers' Association
1944-45

President: *F. E. Cheshire, division master mechanic, Missouri Pacific, Osawatomie, Kan.*

Acting President: *Albert J. Krueger, general superintendent car department, New York, Chicago & St. Louis, Cleveland, Ohio.*

Vice-President: *G. R. Andersen, assistant superintendent car department, Chicago & North Western, Chicago.*

Vice-President: *D. J. Sheehan, superintendent motive power, Chicago & Eastern Illinois, Danville, Ill.*

Vice-President: *I. M. Peters, secretary and superintendent, Crystal Car Lines, Chicago.*

Vice-President: *P. J. Hogan, supervisor car inspection and maintenance, New York, New Haven & Hartford, New Haven, Conn.*

Secretary-Treasurer: *F. H. Stremmel, assistant to secretary, Mechanical Division, A.A.R., Chicago.*

G. R. Andersen

D. J. Sheehan

I. M. Peters

F. H. Stremmel

P. J. Hogan

the committees who have prepared the papers and contributions essential to the continued success of this organization. I sincerely hope that this co-operation will be continued so that we may profit by the peace which is ours and the success which we have achieved, which should spur each of us on to further accomplishments.

Address by Vice-President P. J. Hogan

During my several years of service as car department supervisor, and like others employed in a similar capacity, a part of my duties require a personal contact with shippers desiring to forward, by rail movement, various types of lading used in the construction and manufacturing field such as rotating machinery, tanks, transformers, piling, girders and other items too numerous to mention.

Loading of such material on flat or in gondola-type cars requires a careful inspection as to the design, stability and condition of the lading prior to loading on the type of car best suited for movement to destination.

In addition, the best method of securement to the carrying-car floor, the weight, length, height and width of lading has to be obtained and forwarded to the clearance engineer for clearance authority from point of shipment to destination in order to prevent the possibility of fouling structures along the right of way or rolling stock on adjacent tracks.

After the commodity is loaded on the carrying car, the car foreman or car inspector advises the shipper of the proper loading method in accordance with the A.A.R. loading rules. In cases of unusual type of shipments in which the rules do not apply, a careful study is made as to the proper securement and distribution to avoid failure enroute.

In cases where the lading is of excessive dimensions and cannot be loaded on the regular type flat or gondola car, our transportation department is advised and requested to provide a drop-frame-type or well-type car, depending upon the type of lading.

Shipments which cannot be moved in regular high-speed trains due to excessive dimensions are handled in local service and in many cases move via circuitous routes where structural clearance is sufficient.

As the representative of a carrier operating in a thickly populated area and where clearance problems are a daily occurrence it has been my duty to train car-inspection personnel in making clearance information to suit clearance engineers' purposes.

A single 10-in. by 18-in. blueprint has been prepared on the New Haven showing the dimensions necessary for the passage of over-dimension closed cars and loads on open-top cars. Spaces are left in dimension lines, both width, height and length at all critical points so that the inspector can easily measure an actual load, fill in these dimensions and forward them to the clearance engineer's office at New Haven, Conn. Upon receipt of the dimensions, clearance engineers specify the route, restrictions, etc. In accordance with instructions from the clearance engineers, three excessive dimension cards are filled out for each individual shipment, with one card attached to each side of the carrying car and, as an extra precaution, it is mandatory on the New Haven that a card accompany the way bill.

In cases where special restrictions are necessary due to close clearances, clearance engineers advise the transportation department as to the restricting points along the route and they, in turn, issue instructions to the superintendent in charge of the territory involved so as to avoid any possible chance of error in movement.

In accordance with the A. A. R. rules, railroads originating excessive dimension loads on open-top cars are required to measure such lading and check the figures against the clearance routes over which the shipments are destined, and if found to exceed the authorized figures as shown in "Railway Line Clearances," such loads must be held for clearance authority from the railroads involved in order to avoid unsafe practices.

Address by Vice-President G. R. Andersen

The war is over. What now? As we reminisce and recall many of the problems with which car-department employees were confronted in their endeavor to maintain both passenger and freight equipment in a condition that would minimize complaints and failures, it cannot be denied that they were many and varied. The necessity for utilizing every possible passenger and freight car

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pressed into service equipment that ordinarily would have received general repairs, or perhaps been retired from service. The demand for men to fight our battles likewise removed from railway service many fine practical car men whose absence was felt beyond measure.

These two conditions set up a situation that required all the ingenuity that the remaining car men throughout the country could muster. That they met many trying conditions and obstacles well is reflected in the operation. The pressure is off—we sigh with relief, and thank the powers that be that the struggle ended before the situation got beyond control and interfered with the safe transportation of troops and munitions.

What now? From the fight for victory, we revert to the fight for the survival of the fittest. Competition again enters into the picture, and that is as it should be. In order that we may transport the public with the "greatest of ease," passenger cars must be rehabilitated; that is, such cars as are of an age, design, and possess refinements that are worth the expense involved. Streamline equipment must be purchased in an endeavor to retain at least a good share of the traveling public's patronage. Freight-car equipment will have to be built, rebuilt and retired. The rebuilding must of necessity be done economically, and consequently facilities and tool equipment must be improved. Good judgment will have to be exercised in the retirement of cars and the reclamation of serviceable items from such cars.

The rehabilitation period cannot lag—it must be programmed with reasonable speed in order that the anticipated demands of shippers for the prompt handling of their freight may be met. We enter this period with the man-power situation still far from what it should be; with certain materials still difficult to obtain; with modernization of shops in the plan period, or, if approved, awaiting the availability of help to do the job. So, all in all, mechanical-department officers still have a job confronting them. That they will carry out this assignment to the satisfaction of the officers of the railroads they represent may be depended upon.

L. A. Hartz
Chairman

Painting Now in Transition Period

Value of substitute materials now being appraised—Poor ones being discarded—The variety of colors on freight cars will increase

As a result of great efforts put forth to win the war, no industry has been placed in a more harrowing position than the paint manufacturers. With the curtailment of oils, pigments and resins, many materials were put in use which under ordinary conditions would not have been considered. Some of these materials are still in service and doing a good substitute job, while others have fallen by the wayside never to be resurrected.

We are now in the post-war period and, as we scan the field for probable new materials, we are confronted with the question, What will be offered that will make railroad equipment look better and last longer than the materials in use prior to the war?

From what can be learned, the oxides will predominate in primer coating materials. Alkid resins will be the base materials used in the finish coats.

Much has been said about fast-drying primers and finish coats. Like other materials, there must run through a time-proven method of testing in actual service to demonstrate their dependability and usefulness.

The testing of new materials by the use of accelerated weatherometers has, in some cases, been found wanting, as compared with tests made of materials in actual service. In some cases, these instruments are accelerated to such a high degree that the purposes of a fair test are defeated, and again some materials have been tested in these instruments and passed on to the user apparently with time limit to spare. After five or six months in actual service, these materials have broken down completely, thus leaving us with one proved theory, that mother nature with her elements can and will give us a real test.

Each year, the railroads spend large sums of money for material and labor to paint and keep their equipment in a presentable and protected condition, not only to attract the shippers and traveling public, but to get all possible service out of their equipment.

Much has been said for and against the sandblasting of steel parts on this equipment, but to date no method has been offered that can displace this system of removing rust, corrosion and mill scale to produce a perfect surface for paint adhesion.

Painting Freight Cars

The painting of freight equipment has been done in much the same manner for a number of years, each railroad having its own specifications and formulas for the primers and paints to be used. These specifications and formulas vary and depend on climatic conditions in the different parts of the country through which equipment passes, and in many cases on the commodities transported.

Much has been said for the use of better-grade exterior paints on freight box cars and this seems to be a general trend. Some roads are discontinuing the use of black paint on gondola cars, while other railroads are contemplating painting certain series cars to conform to the colors of their new Diesel freight locomotives.

Without a doubt many changes will be made in the color painting of all freight equipment. With the proposed increase in speed, tendencies may run from drab to bright colors, not only for reasons of public safety, but for the advertising features involved in changes of this kind.

The chairman of the committee which submitted this report is L. A. Hartz, foreman painter, Ill. Cent.

Welding in Passenger-Car Maintenance

A catalogue and discussion of many repairs which can be made advantageously by welding —These include repairing broken castings and restoring damaged exteriors and worn parts

H. A. Grothe, Chairman

The object of this report will be to point out some of the uses that are being made of welding to attain economy and time saving in the repair job, and an improvement in serviceability and appearance.

Body Side and End Sheets

Side sheets are secured to the body frame with rivets or screws on equipment built prior to the advent of the welded car about 11 years ago. Corrosion and damage requires renewals in whole or part, according to inspection. Some railroads in such cases follow a partial renewal program. Sheets found in good condition are left intact, while individual sections, or parts of sections, are renewed and the new sheet welded in place. This practice would eventually result in a car with the surface free of rivets. During the interim, the physical condition will be kept good, the expense at current minimum and the combination of riveted and welded sheets satisfactory from an appearance standpoint.

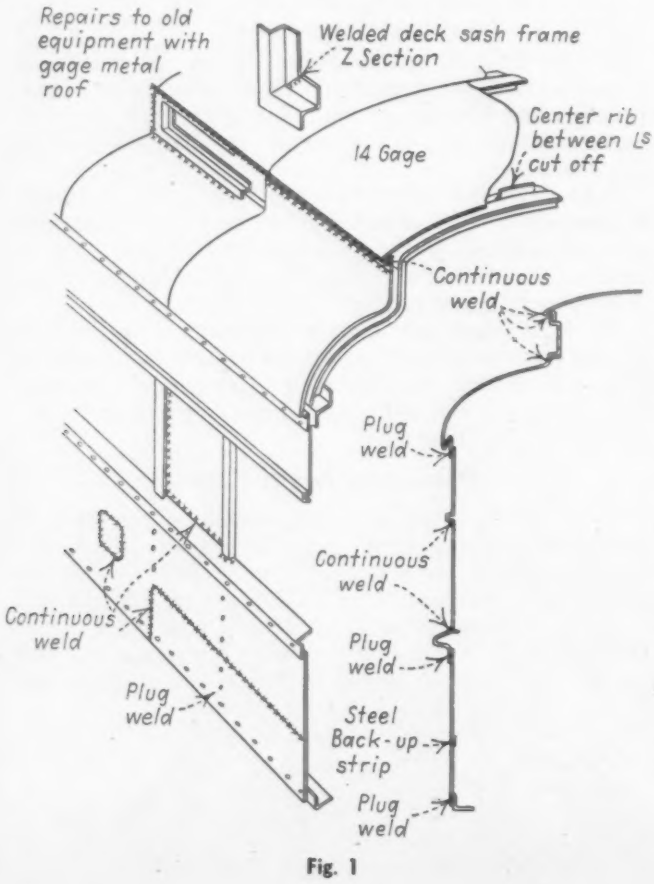


Fig. 1

Fig. 1 illustrates the method and the effect of this transition. It is desirable to extend the length of the new insert from post to post when the section to be patched approximates this length. This permits an easily performed butt weld to the adjoining sheet, and the metal post provides a substantial back-up for the weld seam. In application of multiples of such length, the intermediate posts become the backup for plug welds made in holes punched in the patch sheet before placing in position. The patch sheet need not necessarily be the full height from side sill to belt rail, but may be only that part which requires renewal. In such case, it is practical to install a horizontal backup plate, tack welded in place to the inside of the remaining sheet section.

Cutting out may be confined to small areas, when dented or punctured, and in welding in a new insert various obvious methods are employed to hold the new piece in place until it is welded securely.

Care must be exercised to perform the welding with a minimum of buckling from heat generated in the process of fusion. Selection of the proper welding rod and machine controls, together with step welding, will usually be adequate safeguard. Excessive buckling, if encountered, may be reduced by stretching the affected portion by application of highly-concentrated heat to the inside surface, employing the electric arc for the purpose.

The question of fire hazard is involved in the performance of the operations described, where there is flammable insulation. It is answered by drilling holes in the sheet or section to be removed and soaking the insulation with water. The acetylene torch may then proceed with the cutting operation. Later the insulation is replaced with a non-inflammable type. Before the new sheet section is welded in place the weld seams are backed up with sheet asbestos which, of course, remains in the car walls. To complete the job, weld seams and plug welds are concealed by restoring a smooth surface with a disc grinder.

Posts and Sills

Metal body corner and vestibule posts, window sills, stops, and letterboards are all subject to splice, patching

or complete renewal by electric-welding procedure, though originally secured with rivets or screws.

On account of severe exposure to moisture, the lower part of metal side posts on express cars are found badly deteriorated from corrosion to a point about 3 in. above the floor. Frequently, a corresponding condition exists in that section of the side sheet which may be repaired

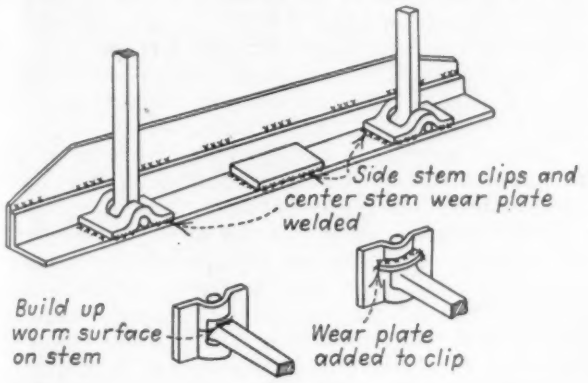
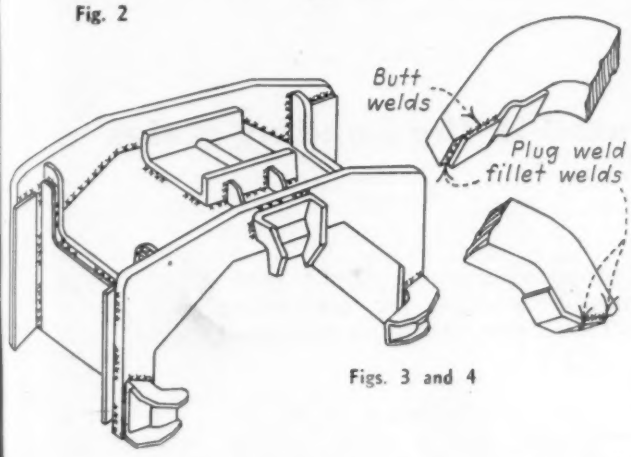


Fig. 2



Figs. 3 and 4

as previously outlined. The defective portion of the side post is cut off and replaced in kind except that to the bottom of the new piece a substantial flat bar has been welded. This permits an enlarged welding connection to the side sill where ordinarily some pitting has developed. The junction of the old post and the new extension may be reinforced with an angle of suitable length and welded.

Car Roofs

In the renewal or patching of roof sheets on cars with roofs of the turtle-back type the procedure is similar to that for side or end sheets.

The older type roof with clerestory, and originally provided with roof-sheet caps and soldered seams, may have roof sheets renewed or partially renewed employing arc-welded instead of soldered seams. Economy in the repair job will be effected, and superior service may be expected. See Fig. 1.

The top roof sheet, if 14-gage material is used, may be butt welded to the adjacent sheet. The metal carline will be the backup, but first the center rib, or projection for the former cap, must be cut off with a torch. If it is decided to retain the lighter 22-gage as the standard, then a lap joint would be essential to permit a satisfactory weld.

The side roof sheets may be of the one-piece or the two-piece type. The one-piece sheet is used when no side-deck openings are present. In this case, the sheet installed extends from the top roof sheet, to which it connects with a continuous weld, to the side plate. At the latter it terminates in an inward bond. This hook engages a separate J-shape of heavier material. This inverted J-shape is then plug-welded to the side sheet at the side plate.

The two-piece-type application for the side roof is required when side-deck openings are present. The same connections at the top roof sheet and the side-plate J-shape are provided as for the one-piece sheet. The junction of the two sheets is made at the lower side roof member. The welding of this seam is contemporary with the introduction of a deck-sash frame constructed of welded sections, and with continuous weld to make waterproof. Asbestos paper is used at joints when the welded seam is to be made.

Underframes, Buffers and Diaphragms

A. A. R. practice outlines standard methods of repairs by welding to underframes. End patform and draft castings formerly scrapped when broken are now repairable. In most cases, forged sections are welded into these as reenforcement or as substitute to sections so badly damaged as not to be restorable in the original.

Considerable welding may be performed to advantage in connection with buffer repairs. Worn side stems may be restored with welding. It is advisable to incorporate a flat plate welded to the clip to effect an increased bearing area, thereby controlling the wear on the side stem. See Fig. 2. Welding at the clips, and of cover- and faceplates to the angle plate eliminates rivets and their upkeep. Clearance of $\frac{1}{8}$ in. for center buffer stems may be controlled by welding into the pocket a U-shaped liner of appropriate thickness.

Trucks

Arc welding is important in repairs to car trucks. Worn surfaces on pedestal legs are built up. Pedestal and roller-bearing outer-housing liners are held in place with welding. Chaffing plates on bolsters and wear plates on cylinder levers are installed with welding. Fractures are repaired and re-enforcements added according to approved practice.

In addition to repairs to roller-bearing housings, electric welding has permitted the design of a successful saddle-type outer housing, illustrated in Fig. 3.

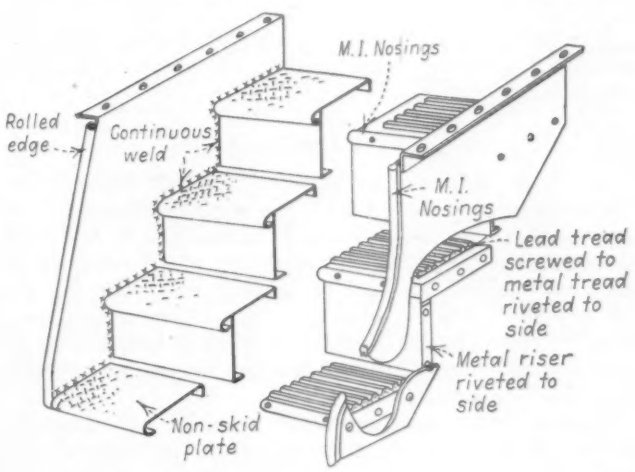


Fig. 5

Wear pads on the equalizer foot, favor economy and safety and may be attached with electric welding, being careful to restrict welding from the critical zone. Fig. 4 illustrates suitable pads of No. 1020 carbon steel, and method of application.

Vestibule Steps and Platform Floors

When wooden or old-style steel vestibule steps require excessive repairs, consideration can be given to replacement with an all-steel welded design similar to that illustrated in Fig. 5. One advantage is the simplicity of construction when compared with the old style having numerous pieces riveted, bolted and screwed together. The treads of non-skid steel plate have proved satisfactory. Another advantage is the provision of a substantial member to which to attach the uncoupling rod bracket and steam valve-rod bracket, also by welding. Steel welded steps, when damaged, lend themselves to simply performed repairs.

Non-skid steel plates for platform floors may be welded in place to save the drilling, tapping and application of screws, which after service are found rusted in to the extent that they require cutting out to remove.

Relatively frequent renewals of under-the-car frame parts of air-conditioning units, which are subject to severe conditions, are performed with facility with the electric arc. Sumps made of Everdur metal may be repaired with welding, as may also the aluminum evaporators.

Supply and battery boxes formerly made from wood, when found beyond repair, may be made of welded construction. If rust-resisting steel is used, they need not be lined.

Consideration should be given, when wood chairs require replacement, to the product available by forming steel tubing and welding it together. The operations are simple and no complicated equipment is required.

Baggage or express-car side doors, when beyond economical repairs, may have renewals made of welded-steel construction that have proven satisfactory.

Electric welding is employed to advantage in repairs to and renewals of sections in dining-car stoves, also in other kitchen fixtures and appointments.

The foregoing report has not attempted to detail all the examples available, but nevertheless furnishes ample evidence of the large variety of uses to which welding is adapted in the maintenance of passenger cars. (The chairman of the committee is H. A. Grothe, shop superintendent, C. M. St. P. & P., Milwaukee, Wis.)

Changes Proposed in the Loading Rules

Most of the proposals involve slight modifications of present wording, or regrouping of provisions—Three new drawings requested

W. A. Emerson, Chairman

The following changes in the A.A.R. loading rules are submitted for your consideration, all proposed changes are shown in italics.

Page 2

Add new sentence to paragraph under the caption "Attention Shippers": Cards bearing advertisements or trademark, or banners, must not be attached to cars, nor to permanent stakes which are a part of the car, nor to temporary stakes supplied by shipper solely for the urose of carrying such advertisements. They may, however, be aplied to the load or temporary stakes used to secure load. *Cards with red printing or red background should not be used.*

Reason: Such cards should be prohibited, the same as railroad cards with red printing or red background are prohibited by Par. (6) in A.A.R. Interchange Rule 36. Their use should be discouraged as much as possible, and, eventually, a penalty for their use should be imposed.

Page 10

Change heading of Item 1 to read: Flat cars with fish-belly center sills and fish-belly side sills, *or flat cars with fish-belly center sills and fish-belly intermediate sills.*

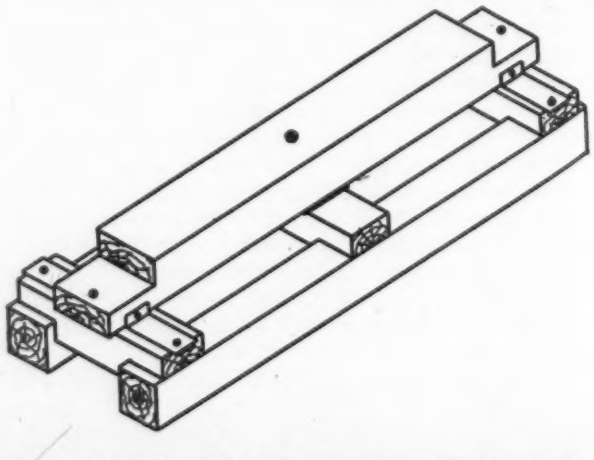
Reason: To include flat cars with fish-belly cented and intermediate sills.

Add new sentence to the heading of Item 4: Fixed end gondola cars. (See diagram below).

Reason: To explain that the diagram applies to Item 4 only.

Page 11

Add new second paragraph to second section of Rule 5: Gondola cars.—Loads not covered by individual figures and where the vacant space across car between the piles and between the load and car sides exceeds a



Proposed new Fig. 66-A—This covers the upside down loading of turntables

total of 18 in., must be secured so as to prevent moving or tipping towards sides of car. *Bulk material, such as ore, sand, gravel, pig iron, etc., should be equally distributed throughout the car.*

Reason: To eliminate controversy concerning weight of load between bolsters.

Page 12

Omit last sentence of first paragraph of Rule 9: Bearing Pieces, Sliding Pieces, Clamping Pieces, Braces, Cleats, Wedges, Blocks. Such items must be of hardwood, when specified under the figure, straight grained, free from decay and strength-impairing knots. Substitute, if desired, suitable metal sections of equal strength; except where metal substitutes are definitely specified. For loading not covered in these detailed rules or figures, they must be of hardwood. *Bearing pieces under loads requiring the use of more than one car must be secured so as to prevent displacement. (Omit this sentence.)*

Reason: The instructions contained in this sentence are provided for in Rule 12.

Transfer the second paragraph of Rule 9, Page 12, to Rule 15, Sec. (a).

Reason: For better grouping.

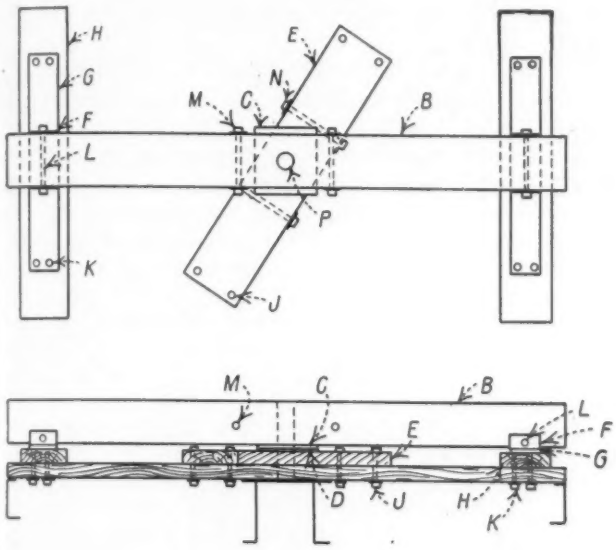
Add new third and fourth paragraphs to Rule 9, Page 12: *When sloping wedges are used for end blocking against vertical surfaces, the flat side of wedge must be placed on floor. Nails or spikes in blocking should be driven vertically to the floor.*

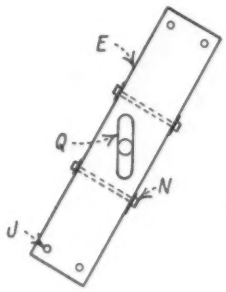
Reason: Wedges with sloping side to floor do not provide full contact with load, and nails or spikes driven vertically to the sloping top of wedge do not provide full resistance.

Page 13

Omit Sec. (a) of Rule 10.

Reason: The same provisions are found in Sec. (d).





Proposed pivoted bolster arrangement for loads on two or more flat or gondola cars

DESCRIPTION	ITEM	NO. OF PCS. PER LOAD	LOAD WEIGHING 15,000 LB. OR LESS PER BOLSTER	15,001 TO 36,000 LB.	36,001 TO 57,500 LB.	57,501 TO 100,000 LB.
Bolster	B	2	8"x 10"x 9'-6"	10"x 14"x 9'-6"	12"x 16"x 9'-6"	14"x 20" or 12"x 22"
Center Plate, Top	C	2	3/8"x 12"x 12"	3/8"x 12"x 12"	3/8"x 12"x 12"	3/8"x 12"x 12"
Center Plate, Bottom	D	2	3/8"x 12"x 12"	3/8"x 12"x 12"	3/8"x 12"x 12"	1/2"x 12"x 12"
Center Plate, Backing	E	2	3"x 12"x 5'-0"	3"x 12"x 5'-0"	3"x 12"x 5'-0"	4"x 12"x 5'-0"
Side Bearing Plate, Top (Bent)	F	4	1/4"x 6"x 1'-3"	1/4"x 6"x 1'-7"	1/4"x 6"x 1'-9"	3/8"x 6"x 2'-1"
Side Bearing Plate, Bottom	G	4	3/8"x 6"x 3'-6"	3/8"x 6"x 3'-6"	3/8"x 6"x 4'-0"	3/8"x 6"x 4'-0"
Side Bearing Backing	H	4	3"x 10"x 5'-0"	3"x 10"x 5'-0"	3"x 10"x 5'-0"	4"x 10"x 5'-0"
Center Plate Backing Bolts	J	8	3/4" Dia., with Washers			
Side Bearing Bottom Plate Bolts	K	16	3/4" Dia. Heads to be Flush with or Below Top of Plate			
Side Bearing Top Plate Bolts	L	4	5/8" Dia.			
Bolster Transverse Bolts	M	4	5/8" Dia. One on Either Side of Center Pin to Prevent Splitting			
Center Plate Backing Bolts	N	4	5/8" Dia. One on Either Side of Center Pin to Prevent Splitting			
Center Pin	P	2	2 1/2" Dia., Long Enough to Rest on Center Sill Cover Plate			
Slotted Center Pin Hole	Q		At one End of Load Only			

All wooden items must be hardwood
Deviations permissible only when specified under individual figures

Transfer Sec. (f) of Rule 10, Page 13, to Fig. 36 on Page 117.

Reason: For better grouping.

Transfer Rule 11, Page 13, to Rule 15, Sec. (b).

Reason: For better grouping.

Page 68

Fig. 5. Include drawing and specifications for pivoted bolsters. (See accompanying sketch.)

Reason: The drawings under individual figures are

indistinct, and, therefore, believed to be the reason for frequent misapplications. Inasmuch as the bolster arrangement in each figure is similar, it is thought that a single drawing, with details enlarged, would simplify revisions of the present drawings, and would provide a clearer understanding of requirements.

Page 186

Fig. 186. Omit "or upside down" in heading, to read: Turntables, Right Side Up, Pivoted Bolsters—Two or more Flat Cars

Reason: Because of the following recommendation for a new Fig. 66-A to cover upside down loading.

New Fig. 66-A. Transfer the first drawing of Fig. 66 to this figure, with enlargements, and add a separate drawing of the pivoted bolster arrangement. (See accompanying sketch.)

Reason: The present drawing is difficult to read, because of compactness. The pivoted bolster arrangement differs from all others, and the details should, therefore, be clearly indicated.

Pages 310 and 314

Figs. 128 and 132. Add a new paragraph, to read: When tanks, etc., which are equipped with domes or other projecting fixtures, are placed on car with such protruding parts located at an angle with the car floor so as to keep the width of load within clearance limits, they must be secured, when necessary, to prevent creeping clockwise or counterclockwise.

Reason: Such material is often loaded with the dome placed in a position about 45 deg. with the horizontal. When not secured, the weight of the dome sometimes causes it to slip downward, resulting in its projecting beyond side of car and frequently exceeding clearance limits.

Page 318

New Fig. 134-A. Heading to read: Long Boilers, Shells, Tanks, etc.—Single Cars, overhanging one or both ends—Flat or Gondola Cars. (Specifications the same as Fig. 134.)

Reason: To provide a figure to cover such loads.

It has been suggested that consideration be given to reprinting the loading rules in either a loose-leaf or pamphlet form for each individual figure, showing thereon all the information required.

Reason: To clarify and simplify reference.

(The report was submitted for the committee by Chairman W. A. Emerson, general master car builder, Elgin, Joliet & Eastern, Joliet, Ill.)

J. E. Keegan
Chairman

Freight Cars for Scheduled Fast Trains

Competent inspectors should select cars for loading — Condition should insure uninterrupted journey — Lubrication attention of utmost importance

With the end of war and return to peace-time operations, the railroads are again faced with greater competition and the necessity for moving freight with the least possible delay. This means that an increasing amount of freight will move in scheduled fast-freight trains and our respective managements will expect these trains to move on schedule. It is up to all of us to get our car-department organizations tuned up to the point where such results will be obtained. They will be obtained only by having cars in such condition at the dispatching points that they will go through to final destinations without delays due to mechanical defects and with minimum delays at intermediate terminals for inspection and lubrication.

The preparation of cars for such trains will require the consideration of several factors—the selection of cars for loading, conditioning of the cars selected, and the lubrication and final inspection in the outbound yards.

The Selection of Cars for Loading

The proper selection of cars for loading is one of the most important of the car inspector's duties and too much stress cannot be placed on the necessity for care and thoroughness. It is hardly necessary to point out the time and expense that would be saved if loaded cars could proceed to their destination, uninterrupted by trips to repair tracks. Experience has shown that most of the loaded cars shopped, have defects that undoubtedly were in existence at the time the cars were loaded and which should have been detected prior to loading. Too often loaded cars are found to be in such condition that repairs cannot be made. This necessitates a transfer of the contents and entails excessive delay, especially at points not equipped for such work. This also may often result in further delays at other terminals, because of the improper loading at the time that the transfer was made.

The first requisite in the proper selection of cars for loading is that the men assigned to this work should be competent and conscientious. They should know what commodity is to be loaded and the type and capacity of the car required. In selecting a car, the inspector should first see that the air brakes and repacking are in date. A thorough inspection should be made of the trucks for defective wheels, journals, journal bearings, truck sides, truck bolsters, spring planks, brake beams, etc., as it is for repairs to these parts that loaded cars are most frequently shopped. Couplers and draft rigging should be examined and of course all safety appliance items. The underframe should be inspected for broken or bent sills, body bolsters and crossties. Flat cars and gondolas

should have good floors, particularly if they are to be loaded with commodities which must be secured with floor blocking.

Care should be exercised in selecting box cars so that they will be suitable for the commodity to be carried. The condition of the floors, sides, ends and doors are important. Too many cars are shopped enroute, due to defects in such parts, and we have all experienced delays and in some instances serious wrecks, due to commodities falling through the car floor, side doors falling off, etc. Particular attention should be given to the condition of outside posts and braces on single-sheathed cars. Many are found to be broken at the plate or sill and when cars are loaded, the side sills are strained. This causes them to sag and in some cases, to break in two.

In selecting refrigerator cars for loading, it is essential that the hatch plugs have a tight fit and are properly secured to prevent coming loose and falling off enroute. Side doors should receive careful attention, so as to insure proper fit and the attachments should be in good condition in order to prevent doors coming open enroute. On account of the importance of this work, the selection of cars for loading should be done as far as possible during daylight hours.

There are several practices which should be corrected, if we are to avoid delays to scheduled freight trains on account of defective equipment. First, is the selection of cars for loading by other than car inspectors. Frequently cars are selected by yard masters, yard clerks, members of switching crews, station agents or other employees who do not have the necessary knowledge of what is required. Second, cars are unloaded in industrial plants and reloaded without having any inspection made. Third, in many instances, no attention is being paid by the transportation employees to the commodity classification. A car is a car to them and to avoid switching out of cars, they will place them at industries for loading regardless of their classification or mechanical condition.

All railroads have methods of identifying cars good for the various commodities, and it is up to the mechanical officer to see that cars are loaded with commodities for which classified and that cars are not loaded if they are not in safe and serviceable condition to carry that load to destination.

Conditioning of Cars

Of equal importance with the selection of cars for loading is the conditioning of the cars selected. Cars requiring repairs should be placed in shops or on conditioning tracks and thoroughly gone over. Owing to the demand for cars and the shortage of labor and material during the war period there has unquestionably been a let down in maintenance of equipment and it will require real effort on the part of car-department officers to impress on the minds of the members of their organizations the necessity for rehabilitating freight cars to such point that they can reasonably be expected to carry their loads to destinations without mechanical delays.

While the cars are in the shops for the particular defects found by the inspector, the common defects for which cars are shopped enroute should be checked. Hot boxes are the greatest cause of delays to cars and so the journal boxes, journals, bearings, wedges and packing should receive careful attention. Trucks should be examined for defective side frames, bolsters, springs and spring planks, brake rigging, wheels and brake-beam safety supports. We are inclined to neglect the latter item which is one of the most prevalent causes for freight-car failures—brake rigging down. Couplers, draft gears, coupler yokes, cross keys and retainers, and yoke rivets should be placed in good condition. Defective draft and center sills should be repaired, as should defective doors, floors, safety appliances, etc. Air brakes should be inspected for leaks, defective brake valves and brake cylinders, train pipes, securements and air hose. Piston travel should be properly adjusted and the brakes tested to know that they are in proper operating condition.

Attention to Cars in Train Yards

Cars selected and conditioned for movement in scheduled fast-freight trains, after being loaded, are switched to train yards for placement in such trains. This switching movement to and from loading points often entails interyard moves over humps and sometimes for considerable distances in large terminals. Therefore defects are apt to develop which will cause considerable delay, thereby disrupting schedules. It must be remembered that these trains may well have schedules calling for speeds equaling those of passenger trains and that the equipment must be in such condition that it can withstand these speeds.

This requires a final inspection, air-brake test, and lubricating attention. Journal bearings should be hooked to locate and remove waste grabs that have developed in terminal movement and the journal-box packing should be adjusted and oil added if necessary. As stated previously, hot boxes are the greatest causes of train delays and we cannot stress too much the importance of proper lubrication of cars. We are inclined to pay too little attention to the qualification, ability and training of car oilers and the work performed by them and the quality of this most important operation suffers as a consequence. We would do well to see to it that the best talent available is employed for the lubrication of freight cars.

Intermediate Attention

Many freight trains travel considerable distances and it is to be expected that some intermediate attention is necessary in order that they maintain their schedules. At such intermediate points, facilities would be provided for adequate fast inspection and lubricating attention. Such facilities as assigned tracks, properly lighted, with repair and lubricating material readily available, inspection pits in yard humps over which cars pass permitting underneath inspection, together with oiling facilities on the humps, are of considerable assistance.

The above outline furnishes a brief description of some of the things that are necessary in preparation of freight cars for scheduled fast freight trains and offers suggestions which we believe will be of material assistance in this important matter.

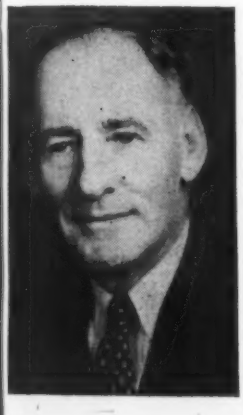
This report was prepared by the Committee on Freight and Passenger Car Maintenance, comprising: J. E. Keegan (chairman), chief car inspector, Pennsylvania; G. E. McCoy, assistant chief car equipment, Canadian National; W. J. O'Brien, general car foreman, N. Y. C. & St. L.; L. H. Day, superintendent car department, D. & R. G. W.; L. W. Dobbins, general car foreman, N. Y. C.; W. E. Geddes, mechanical engineer, Gen. Amer. Trans. Corp.; H. R. Baker, assistant general car inspector, C. B. & Q.; W. H. Hartnett, general car foreman, C. & N. W.; H. E. Wagner, master car builder, Alton & Southern.

Railway Fuel and Traveling Engineers' Association

The Association continues intensive study of train and locomotive handling and fuel economy

PAPERS and reports on various aspects of fuel economy and the problems of training locomotive enginemen and firemen in the technique of handling Diesel-electric and steam locomotives constitute the year's work of ten committees of the Railway Fuel and Traveling Engineers' Association. The annual meeting could not be held because of wartime transportation conditions, but these reports and three additional individual papers will appear in the 1945 year book of the Association.

Reports were prepared by the following committees: Locomotive Firing Practice—Oil; Locomotive Firing Practice—Coal; Front Ends, Grates, Arches, and Ashpans; Utilization of Motive Power; The Road Foreman and the Diesel Locomotive; Air Brakes—Passenger-Training Handling; Fuel Records and Statistics; Black Smoke, How Can It Be Cured?; and Coal. An individual paper was presented on the road foreman's part in educating enginemen and firemen, and two others were sponsored by the Committee on Coal, one on Colloidal Fuel—Its Development and Uses and the other on Conservation of Coal for Locomotives. The Committee on Front Ends, Grates, Arches and Ashpans presented only a brief interim report. Abstracts of the reports of the other committees and of the individual papers appear on the following pages or will appear in later issues.



W. C. Shove,
Chairman

Firing Coal-Burning Locomotives

The essentials of combustion—Vigilance by fireman necessary in controlling the fire—Art of "reading the fire"—Pertinent don'ts

The first essential of firing practice is the preparation of the locomotive for service. Firemen should report at the terminal in sufficient time to make a systematic inspection of the fire condition, grates and tool equipment. It is felt, after trying out the stoker to see that it is operating properly before leaving the terminal, the fire should be maintained in the terminal with the shovel. However, fires can be maintained with the stoker, proper attention being given to the distribution of the coal.

If an engine is fired properly, there are fewer pounds of coal to be handled; little or no necessity for using the rake or slice bar, and cleaning the fire and shaking the grates is reduced to a minimum. A locomotive that is fired properly steams unless there is something radically wrong with it or the coal is devoid of heat units. Even in such a case, proper firing produces the most steam possible under the conditions and the fireman may safely feel that no one could have done better than he did under the circumstances.

Fundamentals of Combustion

In order to fire an engine properly, the fireman need not necessarily know anything about the theory of combustion; he may have learned to apply the principles without knowing the reason for so doing. In fact, many first-class firemen do not understand anything about these principles. There are, however, certain fundamental facts that should be borne in mind when endeavoring to explain to firemen the necessity for doing certain things to get proper results.

To produce heat in a locomotive firebox, three conditions are necessary and only three.

First, there must be a supply of fuel. Second, there must be a plentiful supply of air, and, third, the air and the fuel must be brought together at a temperature at which they will burn.

Soft coal is composed of coke and gases. When coal is thrown on a fire, the gases are driven off by the heat, the coke remaining on the grates. Both the coke and the gases will burn, but before any burning can take place, they must be supplied with air at what is called the igniting temperature. Air is made up of several gases, one of which is the particular thing required for burning the coke and the gases in coal. This burning will not take place until the fuel and the air are heated to a certain temperature, called the igniting point. The fact that air is absolutely necessary for burning can be proved by experimenting with a tallow candle. If the candle is lighted, it will continue to burn so long as plenty of air is supplied to it, but if a milk bottle is placed over the candle it will immediately begin to smoke and the flame will grow long and as soon as the limited amount of air which the bottle contained has been used up, the burning will stop.

If too much air is supplied to a fire, it will interfere with the burning. This can be demonstrated by blowing on the flame of a tallow candle. Blowing easily will not, apparently, reduce the flame very much; blowing steadily and strongly will almost put the flame out, and a sudden sharp breath will extinguish it entirely. The application of this will be spoken of later. The statement that the air and the fuel must be brought together at a temperature at which they will burn can also be illustrated by means of a candle. Before the candle is lighted, fuel is present surrounded by a plentiful supply of air, but the

condition of proper temperature is lacking. The fuel of the candle must first be heated to a temperature at which it will start to burn. When the candle is burning, the action that takes place during the burning supplies sufficient heat to maintain the fuel at the burning temperature. If this condition is interfered with, however, as illustrated by blowing the comparatively cold air from the lungs against the flame, the temperature is reduced below the burning point, the flame goes out, and the burning will not begin again until the temperature has once more been raised to the burning point.

With the three conditions of fuel, air and proper temperature present, burning will always take place, whether it be in a locomotive firebox, in the open air or in the finest home or office, but with any one of these three conditions lacking, burning absolutely will not take place.

When burning does take place the fuel disappears, with the exception of the ash and the dirt that are in the coal and these remain on the grates. This disappearance of fuel is due to the fact that in the process of burning a chemical change takes place by which the air and the fuel unite to form gases. These are drawn out through the flues into the front end and from there pass out through the stack with the exhaust. During this changing process the heat necessary for steam-producing purposes is evolved.

While there are many different kinds of fuel which may burn in many different ways, anyone who thoroughly understands the basic principles set forth above can understand and explain most of the actions that take place in a locomotive firebox.

In describing the actual work of firing a locomotive, it is necessary to assume that the engine is properly drafted and is in proper condition to burn the fuel economically.

The Fundamentals Applied

In starting out, the fireman should endeavor to have a light, level, bright fire. These three conditions should always exist in the firebox. The thickness of the fire should be regulated by the class of fuel, the drafting of the engine, and the weight and schedule of the train.

The fire must be light because the amount of air that can be supplied in a locomotive firebox is always limited. If the fire is too light, the draft will pull such a large volume of cold air through it that the temperature of the gases will be reduced below the igniting point and proper burning will not take place. This condition can be ascertained by observing the fact that the steam pressure immediately falls and no smoke appears at the stack even when fresh fuel is thrown on the fire.

It is not so easy to recognize the condition when the fire is too heavy. Proper results, however, cannot be obtained with a thick fire. It is practically impossible to get sufficient air through a thick fire to burn the large volume of gases that are liberated from the fuel and the result is that when fresh fuel is thrown on the fire, although there is sufficient heat in the firebox to drive off the gases from this fuel, there is neither the proper igniting temperature nor the requisite air supply to burn them. These gases, however, as soon as they are liberated from the coal are pulled through the flues by the exhaust and as the conditions in the firebox have not been such as to allow them to burn and as these gases are the principal heat-producing part of the coal, it will readily be seen that a large amount of heat is wasted.

The fire should be level for the reason that if the locomotive is properly drafted, there is an equal pull of air through the entire grate area, but if the fire is banked at one place and low at another, the air seeking the easiest channel for entrance will, for the most part, pass through the place where the fire is light, very little air passing through the place where the fire is banked. This gives an unequal distribution of air to the fire and creates the same effect on one part of the fire as though the draft were too light, and on the other part as though it were too heavy. This is further and better illustrated in cases where there is a hole in the fire. In such cases, nearly all of the air passes through the hole and very little through other parts of the fire with the consequent result that the steam pressure immediately responds to this condition and the pressure cannot be regained until the fire is leveled over, and the proper conditions for burning are once more obtained. A condition of this kind is very hard on the boiler as well as on the steam pressure.

Firemen should never be allowed to think that the mechanical stoker is anything but a machine that was designed to place an even layer of fuel over the fire bed. It does not know what portion of the firebox is using the greatest amount of fuel, neither does it know where a bank has been started; it is always necessary for a fireman to keep almost constant watch of the fire at all times.

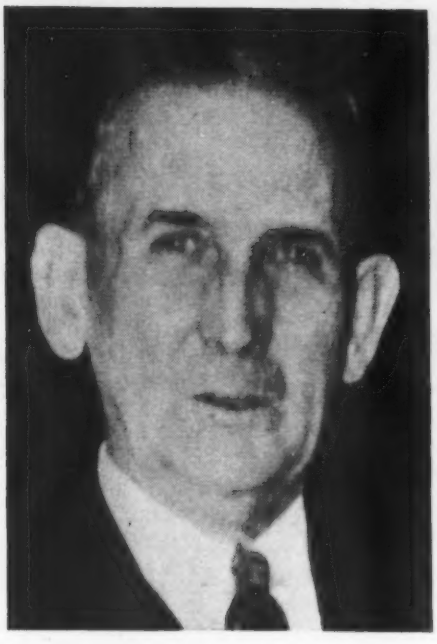
It is a rather difficult matter to so adjust the front-end draft appliances so as to produce an even flow of air through every part of the grate area, which, of course, means the fuel bed also, and as the rate of combustion is proportional to the air flow, it follows that there may be—in fact will be—a difference in the amount of coal burned over various sections of the grate. However, if this difference is only over the front or back sections of the grate—that is, if the engine burns more coal ahead or behind—it is a comparatively easy matter to adjust the rate of firing to meet the need, either with the scoop or by regulating the pressure on the stoker distributing jets where the engine is mechanically fired. Where the engine burns a "spotty" fire—that is, with an entirely different condition, especially where the locomotive is not equipped with a multiple-valve distributing jet where each valve allows the pressure to be manually controlled. In such cases the only recourse is to supply that particular spot where the burning rate is highest with the scoop instead of blowing the coal in haphazardly and trusting to luck that some may fall in the right place.

A somewhat similar condition obtains where, through some obstruction, the air flow is restricted at some particular spot, thus reducing the burning rate at that spot, resulting in the gradual formation of a bank which may in turn result in the formation of a clinker and thus stop combustion entirely at that point. In this case the right thing to do is to shake the grates lightly before the clinker forms and then with the scoop, or by regulating the jet pressure, fire around that spot until the bank gradually burns down. However, if the clinker has already been formed, then there is nothing to do except to try to loosen and up-end the clinker, or, if possible, remove it, and then with the hook spread live fire over that spot and then supply less coal to that point to prevent the formation of another bank or clinker. If a clinker once starts to form and is not broken up at the start, it will continue to grow and ultimately affect the steaming of an engine.

There are several types of stokers now in use that are fitted with adjustable vanes or deflectors. These can be adjusted so as to reduce the amount of coal delivered to either side or either back corner, but cannot be set to reduce or increase the amount of coal delivered to any particular spot in the fuel bed. Therefore, we must either resort to the scoop, or, if the stoker is fitted with a multiple control distributor jet, adjust the jet pressures to deliver coal only to the place where it is needed.

In all cases, regardless of whether the engine is fired by hand or with a mechanical stoker, the fireman should be taught to "read" the fire regularly and often. This is an easy matter for the older and experienced firemen.

E. E. Ramey



L. E. Dix

W. C. Shove

Officers
Railway Fuel and Traveling Engineers' Association
1944-45

W. R. Sugg

President: *L. E. Dix, fuel supervisor, Texas & Pacific, Dallas, Tex.*

Vice-President: *E. E. Ramey, superintendent fuel conservation, Baltimore & Ohio, Baltimore, Md.*

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T. Duff Smith

but must be learned by the novice. The best method of doing this has been explained in preceding reports, but as these may not be available are here quoted again:

"In order to 'read' the fire, stop firing until the smoke clears at the stack, then open the fire door, turn the scoop over so as to deflect a stream of air over the fuel bed. The dark spots will show where the fire is not burning properly. The bright spots will show where the fire is burning as it should, where combustion is most rapid and where the most coal should be supplied. Now if regardless of all efforts to get an even fire, holes or banks continue to form, the matter should be reported on arrival at the terminal. For instance, if the fire burns spotty, report 'Examine the grate,' but if the fire burns fairly uniform but more at the front or back of the box, report 'Examine and adjust front-end appliances; engine burns too much coal at the front or back (as the case may be).'"

Firing practice as a general thing is developed to the degree that supervision on the respective territories insists upon. If the road foreman, fuel supervisor, traveling fireman, and others supervising the work of enginemen do not insist on the best-known methods of firing practice, the natural trend is for new firemen to drift into methods of their own, which are not in all cases conducive to fuel economy or good practices.

Boiler feeding is an outstanding factor in fuel economy and fire condition. The most economical method of boiler feeding is to operate the feedwater pump or injector continuously, or as nearly so as possible, and adjust the feed according to the condition of the run. It is recommended that on leaving the initial terminals the injector be used the first few miles in preference to the feedwater heater, or until the arch is hot and the fire is set.

In no other situation is close co-operation more important between two persons than between the engineman and fireman in the cab of a locomotive.

An engineman who has been thoroughly schooled in good firing practice on a locomotive is in a position to instruct new firemen in the correct methods of firing practice. Each engineer should take a special interest in educating new firemen.

Safety

Don't forget safety is of first importance.
Don't walk through escaping steam.
Don't walk between moving engines or cars.
Don't walk on tracks without keeping a sharp lookout in both directions.
Don't get off locomotive without looking in both directions.
Don't cross tracks between locomotives standing close together on the same track.
Don't lean beyond line of cab without exercising care to avoid being struck at points where clearances are close, or while passing trains.
Don't jump over storage, ash, or inspection pits.
Don't get off a locomotive face first.
Don't carry grips, clothing or tools while alighting from or boarding a locomotive.

Fuel Conservation Don'ts

Don't leave terminal unless fire is in good condition.
Don't overfill scoop shovel.
Don't allow rock, iron, wood, or other foreign matter to be fed into stokers.
Don't allow safety valves to open unnecessarily.
Don't allow a dirty locomotive deck or apron.
Don't knock coal off by careless handling of tools.
Don't throw large lumps in the fire.
Don't use the blower except when necessary.
Don't permit fire to get heavy or dirty.
Don't "die on a full stomach." Never feed more coal than needed.
Don't allow fire to die out in the forward end of firebox, causing flues to leak.
Don't permit banks to form in the firebox.
Don't leave the fire door open while descending grades or stopping.
Don't shake grates excessively.

Shaking grates is an important factor in connection with good firing practice. Grates should be shaken often enough to keep dead ashes off the grates, not allowing fire to become so heavy that it restricts the free flow of air to the firebox.

No standard can be set up that will apply to all roads under all conditions as to how often and how hard grates should be shaken. This will depend on the quality of coal fired in a given period.

By observing the above we won't make unnecessary dense smoke and will conserve fuel.

The committee consists of W. C. Shove (chairman), general road foreman engines, N. Y. N. H. & H.; H. E. Tewksbury, traveling engineer, Bangor & Aroostook; C. Harding, road foreman engines, L. & N. E.; W. E. Small, chief fuel supervisor, B. & M.; F. X. Jones, supervisor fuel and locomotive operation, Erie; J. H. Simmons, N. Y. C.; H. Morris, superintendent fuel and locomotive performance, C. of N. J.; S. M. Roth, supervisor locomotive performance, W. Md.; C. B. Curtis, road foreman engines, R. F. & P.; W. R. Sugg, general supervisor air brakes, Mo. Pac.; H. T. Clark, supervisor of locomotive operation, B. & O.; A Baxter, D. & R. G. W.; W. E. Beaver, general road foreman engines, Southern; R. A. Reeder, superintendent fuel and locomotive performance, Reading; J. W. Crawford, road foreman engines, Wabash; and J. Mattise, general road foreman engines, C. & N. W.

S. A. Dickson, Chairman

Report of the Committee on Coal

Reiterates recommendations which have been offered on previous occasions looking toward standardization of coal sizes by the mines

[In addition to its own report, the committee contributed two papers, one on "Some 1945 Ideas about the Use of Coal for Locomotives," by J. F. Barkley, Chief of Solid Fuels Administration for War, U. S. Bureau of Mines, and the other on "Colloidal Fuel—Its Development and Use," by D. W. Machin, combustion engineer, Pittsburg and Midway Coal Mining Company. These appear separately.—EDITOR.]

The general impression seems to be that the prevailing general coal shortage will extend well into 1946. The war and all of its disturbances seems to have given birth to the idea that the railroads can take care of themselves with varying kinds and qualities of (mostly) low-grade coals. But, beginning at some time after the war is over, an accelerative competitive condition will doubtless occur in transportation, with new efforts on the part of railroads to gain better efficiency and reduced costs. This will likewise doubtless manifest itself in continued efforts to further develop a standard design of motive power other than the steam locomotive. This committee believes the coal industry will maintain or decrease their sales of coal for locomotive use dependent largely on their efforts and ability to keep their costs, and selling prices, down and to furnish a uniform high standard of preparation, sizing and quality of coal, and also to supply their best research on coal and combustion problems in co-operation with the railroads. In other words, they must forget the past and realize there is serious competition for them, which has to be met, not ignored or dodged.

Fuel problems on the railroads are important, as we have been asked by those in authoritative places to make as good use of fuel as possible, so that more of it would be available for other uses. The disadvantages of using coal of inferior preparation on locomotives are so obvious as to scarcely call for explanation. Not only does it take more coal with the new men we now have in service, but in many cases it slows up the movement of power, which is important, because if ever the railroads needed to move trains expeditiously, it is now. Also economy in fuel usage, because of the demand being greater than the supply, is more necessary now than ever before. It is difficult to maintain motive power up to the same standard as in normal times and this, too, is a factor, so that putting the three factors together—namely, fuel, new men, and motive power which is not up to par—you have a combination of conditions that makes it difficult to control present-day problems.

There is a program of research bearing on the development of a modern, more efficient coal-burning locomotive that is being participated in by the railroads, the coal industry, locomotive builders, electric companies, machinery and boiler makers. The fuel people with each railroad are conversant with this progressive program. We suggest that all consistent avenues of thought be put into it.

Standardization of Coal Sizes

There are a great variety of sizes of coal screened by a multitude of coal producers. Many railroads traverse two or more coal-producing districts. The mines are likely to produce as many as twenty different sizes. In some situations there are likely to be a half-dozen different sizes of slack, for instance—everything from ⅜ in., ½ in., ¾ in., 1 in., 1⅛ in., 1¼ in., 1½ in., and so on—and egg coal, for example, somewhat the same way. This is all a pretty deep subject, but shouldn't the coal producers get together and stabilize this?

Repeated recommendations have been made with reference to sizes, as follows: Two-inch minus for stoker use; four-inch minus for hand-fired locomotives, with the further recommendations that adaptability and performance of the coal be the first determining factor; then, secondly, the methods of production, coal preparation and cleaning used by the producer of the coal.

Stress the desirability of co-operation and a broad-minded attempt to have the coal producer understand the railroad's problem and build up an idea in his mind that there is a partnership angle to the production and use of coal by the railroads. This is an obvious proposition to all who will think of it and there is a serious postwar condition to be taken care of by the coal companies and railroads; first, for the coal man, to hold his market for coal consumed by railroads as against competition from other fuels and other forms of transportation, and also for the railroad to get the cheapest form of power from coal. Let it be our aim to try to help this situation in every way we can.

[The report included an extensive discussion of the minimum essential instruments for use in small stationary boiler plants to provide the most effective control of the efficiency of plant operation without involving too great expense or complexity of control. This section has been omitted from this abstract.—EDITOR.]

Uses of Northwest Coals

On one division of a western railroad Montana coal is used in freight and yard service. The analysis of this coal approximates the following:

Moisture, per cent	3.75
Volatile, per cent	30.19
Fixed carbon, per cent	43.21
Ash, per cent	22.85
Coking	Semi
Sulphur, per cent	4.28
B.t.u.	10,070

The coal will not always run 10,070 B.t.u. or 22.85 per cent ash. The ash will run much higher and the B.t.u. lower. This coal is rather hard and often will contain considerable amounts of sulphur balls and bone coal.

This type of coal will steam well if engines are properly drafted and the ashpan construction is arranged to give a good free volume of air under the grates and is made as large as possible to hold a large amount of ash. It has been their experience on large power and heavy freight tonnage that 75 miles is about the limit for holding ashes in the pan. The fire will have to be shaken down about every 15 miles or the firebox will become badly filled up with ash, resulting in excessive fuel consumption and poor steam.

If this Montana coal is handled properly, the fire will give very little trouble from clinkering. The nozzle tips are reduced from ¼ in. to ¾ in. smaller than on engines burning fuel oil or Eastern coal.

On one district of 156 miles a coaling station is 75 miles from the terminals and at this station there is a mechanically operated ash pit so that pans and fires can be cleaned quickly. On engines handling such excessive ash, there must be an efficient swipe to clean out the side and keep the air openings free of ash under mud ring.

Whenever the ashpan has to be dumped between coaling stations, it is the practice to cut off the engine, pull into a passing track, open the ashpan hoppers, and swipe out the pan clean. Pans are never opened up while running on main line; all ashes must be dumped in passing tracks.

In power plants where Montana coal is used the ash problem can be handled by a mechanical ash-conveying system and suitable stokers.

In stationary plants where this type of coal is pulverized, the temperature of the fire becomes considerably higher and much slagging takes place on the water tubes and side walls. Where boilers are being forced to a high per cent overload, slagging becomes excessive. When this coal is hand fired and handled properly, not using the hook in trying to break up a green bank of fuel in the firebox, the coal will not clinker, but if the fire is very hot and the hook is used, clinker formation becomes excessive.

North Dakota Lignite Coal in Power Plants

North Dakota lignite is not used as locomotive fuel but is used in two large stationary plants where direct steaming is used throughout the enginehouse. Each one of these plants produces 25 to 30 million pounds of steam per month.

The lignite coal itself has a high percentage of moisture and will give the best results when fired wet. Over a chain grate stoker it will have ample time to dry out sufficiently to give proper combustion. When this coal is fired dry that fly ash formation on the side wall of the furnace will become excessive.

North Dakota Lignite Coal as Locomotive Fuel

A western railway in 1935 ran some tests with a 2-8-2 type locomotive. It carried 175 lb. steam pressure, had 28-in. by 36-in. cylinders, and developed 53,000 lb. tractive force. It carried a seven-row sealed arch and was equipped with Cyclone front end with opening toward the flues. The stack was 18 in. in diameter and had an

extension 20 in. in diameter which reached to within 17¾ in. of the exhaust nozzle. The ⅜-in. round-hole grates were fired by a BK stoker with a special distributing plate. The capacity of the tender was 12,000 gal. and 16 tons. The standard nozzle for this class of locomotive with conventional front end is 6⅛ in. open and with Cyclone front end, 6 5/16 in. open.

The grates used on these tests have eight rows of ⅜-in. by ⅝-in. round holes and have 20 per cent less air opening than the standard ½-in. round-hole Rosebud grates. The edges of the grate bars have an overlapping feature which effectively seals the openings between the grate bars, forcing all draft through the ⅜-in. holes and resulting in very good air distribution throughout the fuel bed.

The eastern coal used on these tests was Pittsburgh No. 8 mine-run, 13,500 to 14,000 B.t.u., costing $4.15 per ton plus 30 cents handling. The lignite coal used was from North Dakota, screened 2 in. by ½ in., 7,000 B.t.u., 6 per cent ash fusing at 2,350 to 2,400 deg. It cost $1.15 per ton.

From tests with the same engine it was found that with straight eastern coal the evaporation was 5.92 to 6.09 and with 70 per cent lignite to 30 per cent eastern coal, 3.71 to 4.12. It was also found that with lignite coal, which burns with a long flame, and a level fire not over 2 in. on grates, steam temperature readings were obtained as high as 698 deg., equivalent to over 320 deg. of superheat. On trips using straight lignite steam temperature readings of 700 deg. and over were obtained.

The engine had a clear stack at all times. The fire, seen through colored glass, appeared to be getting a uniform mixture of lignite and eastern coal from the rundown into the stoker trough and the distribution of coal in the firebox was good; every air opening in the grate could be distinguished. The flame travel appeared to be much longer using lignite than when using eastern coal, resulting in higher superheat due to the flames licking the flues. The fire over the entire grate area was agitated with every exhaust and most of the ash carried out of the stack.

From the test conducted in locomotive service with lignite coal the consumption in tons would be high and to handle such fuels would require coal sheds which would have to be closer together and a greater amount of fuel placed on the tenders.

The committee is composed of S. A. Dickson (chairman), supervisor fuel economy, Alton; G. E. Anderson, general fuel supervisor, Grt. Nor.; W. L. Sheppard, assistant to vice-president, Pittsburgh Coal Co.; J. F. Barkley, chief, Division of Solid Fuels Utilization for War, Bureau of Mines; W. J. Tapp, superintendent fuel conservation, D. & R. G. W.; Joseph Harrington, advisory engineer, Northern Illinois Coal Corp.; A. F. McElhenie, vice-president and sales manager, Pittsburg & Midway Coal Mining Co.

Frank Kurz,
Chairman

The Firing of Oil-Burning Locomotives

A discussion of the various factors affecting the quality of the performance of oil-burning steam locomotives with emphasis on fuel economy

In general, improvement in fuel performance is attained by combination of some rather fixed factors, such as the proper design of boilers, front ends, fire pans and draft openings; applicable factors, such as fuel-saving devices tending to decrease the water rate per indicated horsepower, and, finally, the fluctuating factors, such as locomotive maintenance, train loading, train dispatching and locomotive firing and handling practice.

The conventional steam locomotive continues in use despite low thermal efficiency because of the simplicity of design and relatively easy maintenance, low initial and maintenance costs, and low cost and plenitude of fuel. Conditions obtaining during the war favored improved fuel performance despite the handicaps of relatively poor firing practice by inexperienced men, due chiefly to the large volume of traffic and incidental heavy train and locomotive loading. With the recession of the war effort and the easing of loading restrictions, the true import of fuel conservation will become more and more evident.

To attain this end, of all the several avenues mentioned above, the most important and fruitful source of improved performance will, of course, be proper locomotive firing practice. Fuel oil for some time to come will continue to be purchased under present specifications. Steam locomotives will be somewhat older, but the same general performance of boilers can be expected. It is in the actual use of the oil-burning appurtenances and the co-ordination of the fireman's efforts with the maneuvering of the locomotive by the engineman that the greatest field for fuel conservation lies.

When one considers that of the total heat units in the fuel approximately two per cent goes to heating fuel, five per cent to the operation of boiler feed pump and injectors, five per cent to operate air compressors, 14 per cent or more is lost with gases of combustion, 45 per cent is lost with the exhaust steam, five per cent is lost through radiation, one per cent goes to atomizer, and 15 per cent is lost through internal friction, it is evident that the remainder available for moving the train is less than eight per cent. While every one of the above items constitutes a big subject by itself, it is only the operation of the locomotives and fuel-oil-burning appurtenances which will be the subject of this report.

It is not difficult to start an argument among engine-

men as well as supervisors when it comes to proper methods of locomotive operation and firing. A casual check of fuel performance will indicate that for a given train schedule the fuel burned may vary as much as 20 per cent from day to day. Such a variation alters operating costs materially, especially for locomotives that may burn $100 worth of fuel per day.

While the engineman is in charge of the locomotive and should instruct the fireman how to do his work properly, it is still a fact that the fireman is the man who produces the steam which the engineman uses. Heavy fuel oils such as used by nearly all oil-burning railroads today must be heated. While the oil may burn at a temperature as low as 110 deg. F. or as high as 180 to 200 deg. F., somewhere between these limits is a temperature where the best and most efficient results will be obtained for a given fuel oil. There are enginemen who believe that relatively cold oil produces the best results; there are others who believe that the same locomotive requires extra hot oil to obtain the best results. Both cannot be right. To save fuel oil the temperature that will produce the best efficiency and good operating results should be determined and maintained.

Where the Fireman Shows His Skill

It is at the firing valve and the atomizer valve where a continual concentration on the job is necessary for successful fuel performance. Fuel is fed to the firebox as it is burned. To maintain a constant high steam pressure which is necessary for most economical operation of the locomotive, the firing valve must be changed with each change of steam demand. Similarly, the regulation of the boiler feed pump or injector should be such as to maintain the proper water level. Permitting the steam pressure to drop, then forcing the fire to regain the pressure or letting the water vary up and down is obviously wasteful of fuel. The maintenance of uniform high boiler pressure and proper water level means constant attention to duty.

The subject of proper water level is another which frequently may bring argument with men in charge of the locomotives. However, it is obvious that while ample water must be maintained in the boiler for safety both on an ascending or descending grade, it is also necessary that the water be kept down to a reasonable level. The relatively small steam space in the modern locomotive boilers is reduced by high water which also results in the entrainment of a great amount of moisture in the superheater units which results in a drop in the superheater temperature, depositing scale and sediment in the interior of the superheater tubes with continued subsequent low superheater temperatures and incidental superheater unit failures. Each of these conditions adversely affects fuel performance. In addition, where water is carried over in quantities, lubrication in the cylinders is destroyed and damage to machinery may ensue.

The skill of the fireman is revealed in the operation of the locomotive firing appurtenances in such manner that black smoke or, in fact, any smoke other than a light haze at the stack will be eliminated. Too clear a stack may indicate excessive air for the amount of fuel being burned with resultant greater losses through the stack. The maintenance of proper fire under all conditions will not only reveal itself in improved fuel performance but in the reduction of boiler maintenance due to the elimination or minimizing of high temperature differences which are coincidental with poor firing.

Mention should also be made of the proper sanding of locomotives. Soot is well known as having insulating properties. Periodical sanding of the locomotive flues will do much toward elimination of losses in the transmission of the heat from the hot flue gases to the water and steam.

The Engineman's Part

The skillful work of a good fireman may be nullified by the less skillful operation of the locomotive by the engineman. The avoidance of unnecessary speed fluctuations which involve train acceleration or deceleration is necessary to improve fuel performance. The extra energy required to accelerate the train is all dissipated through the heat at brake shoes when the brakes are applied.

It is obvious that undue train interferences, which are regulated by train dispatching, and other unnecessary slow-downs from high speed always mean that more fuel must be burned to regain the speed, all having an adverse effect upon fuel consumption. All extra stops and delays reach back into the fuel tank.

The skill of the engineman is also reflected in his ability to get the best combination of throttle and cut-off. It is well known that cut-off is lengthened to increase the power and shortened as speed develops. For a given condition there is a best setting for the throttle and reverse lever. While the engineman depends to a great extent on his experience and the feel of the engine, it is obvious that in this regard individual enginemen do not always agree as to the best practice. Continued instruction and training is necessary in order that the greatest possible amount of B.t.u. be extracted from each gallon of oil and put to work in the hauling of the train. It is a well-known fact that a cut-off as short as good operating results permit saves fuel.

The fireman should be at the firing valve when the locomotive is started, increasing the fire immediately when the throttle is actually opened and reducing it likewise immediately when the throttle is closed. The flow of oil should be gradually increased as required to avoid black smoke. The fireman should anticipate every change in the position of the throttle or reverse lever while running and regulate the fire accordingly. When switching or on the road, the fire should at all times be regulated to suit the work the locomotive is performing. When the driving wheels slip the firing valve should be opened sufficiently to guard against the fire being extinguished by the excessive draft. When the exhaust is increased sufficiently, the blower valve should be closed and the firing apparatus readjusted to suit conditions. As a strong draft in the exhaust may snuff out a low fire, the stronger the draft the greater must be the oil supply. Care must be exercised against the sudden opening of the firing valve, as excessive flow of oil may cause gas explosions and black smoke.

Carbon formations in the firebox are evidence of imperfect combustion and extravagant use of fuel. A white incandescent color at the peep hole in the firing door and a slight haze of smoke at the stack reflect the most desirable firing conditions. The firing valve, not the injector or feedwater pump, should be used to control the steam pressure. Steam pressure should be maintained as constant as possible and near to the maximum working pressure without permitting the safety valves to open. When oil-burning locomotives are standing or drifting, a light fire should be maintained in order to have as nearly as possible uniform firebox temperatures to prevent injury to the firebox and flues.

Finally, the greatest economy should be practiced at all times in the use of fuel, exercising good judgment and harmonious co-operation with the engineman, showing a willingness to learn and practice the best methods.

The committee consists of Frank Kurz (chairman), fuel engineer, S. P.; T. J. Higgins, road foreman of engines, T. & P.; C. I. Evans, chief fuel supervisor, M-K-T; R. N. McKitterick, fuel supervisor, A. T. & S. F.; H. L. Malette, road foreman equipment, St. L.-S. F.; and R. N. Booker, district road foreman engines, S. P.

W. D. Quarles, Chairman

Managing the Diesel Locomotive

The report is devoted to a study of the fuel system, the lubricating-oil system and the cooling-water system

Even in normal times the problem of dirty fuel is always present due to lack of facilities and care in handling the fuel supply. Clean fuel means more efficient operation, less maintenance to equipment such as fuel pumps and injectors. In a previous discussion you were very ably informed of the ruggedness of the injector and that the clearance between the plunger and bushing was highly machined and to the millionth of an inch. The fuel pump works on the principle of internal gear and drop-off in capacity is generally caused by slight abrasive action of foreign material in oil resulting in end play of the rotor.

The requirements of good clean fuel oil now bring us to our fundamental fuel diagram shown in Fig. 1.

The Fuel System

Each unit comprising the locomotive has its own fuel tank having a capacity of 1,200 gal. At the bottom of the tank are two sumps, the tank sump and the supply sump connected by the emergency fuel cut-off valve. The suction line to the engine enters the supply sump and can only draw fuel if the cut-off valve is open. The emergency fuel cut-off valve is a federal requirement and has to be operative from inside the unit as well as from both sides near the filling plug. It is a spring-loaded valve to be used in case of fire to stop the engine when it cannot be stopped in the usual manner. Each fuel tank has two vents, one on each side with 4-in. flame arrestors terminating outside of the locomotive. This arrestor voids any possibility of a fuel-tank explosion.

Before oil enters the supply pump it passes through the suction filter. Until recently these were three-thousandths spaced wire-wound drums. The handle which operates the drum scraper should be turned every hour while the engine is running. The latest filters, however, are waste packed and should be changed regularly. The elements are repacked with eight ounces of wastex.

The fuel pump is either single or dual. The pumping principle is known as the internal gear principle. An electric motor furnishes the power applied to the rotor which is transmitted to the idler gear with which it meshes. The space between the outside diameter of the idler and the inside diameter of the rotor is sealed by a crescent shaped projection fastened to the cover. As the teeth come out of mesh, there is an increase in volume which creates a partial vacuum. The fuel enters the pump to fill this vacuum and stays in the space between the teeth of both the idler and rotor. When the teeth mesh the fuel is forced from this space and out of the pump. The capacity when pumping against 35 lb. pressure is two gallons per minute. However, it is capable of pumping against a pressure of 150 lb.

The Ful Flo filter is connected between the fuel pump and the sintered-bronze filter. Inside the filter are three

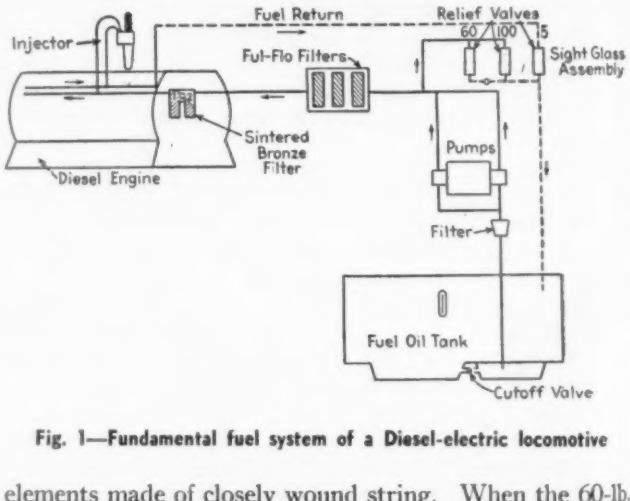

Fig. 1—Fundamental fuel system of a Diesel-electric locomotive

elements made of closely wound string. When the 60-lb. sight glass shows fuel by-passing, turn the handle on the duplex filter to determine whether it is the duplex or the Ful Flo which needs cleaning. If the Ful Flo filter is dirty, all three elements should be replaced and the drain plug at the bottom removed to drain any water accumulation. After reassembling the filter, be sure to vent all air from the chamber through the vent valve on top.

The duplex sintered-bronze filter is mounted on the accessory end of the engine and has a handle which can be swung in three positions. With the handle to the left, the left-hand element is cut off. With the handle to the right, the right-hand element is inoperative. With the handle straight down, both elements are filtering. The handle should, however, either be to the right or left with only one element filtering. The cleaning frequency can best be determined by inspection until a definite schedule can be established. From the duplex

bronze filters the fuel goes to the supply header or manifold running to all cylinder heads in both banks of the engine. Just as the fuel enters the injector, it is filtered for the fourth time by small thimble-like sintered-bronze filters. The purpose of all filtration is solely to protect the injector. Every precaution must be taken to protect this finely machined, yet rugged, equipment from getting any dirt inside.

A surplus of fuel passes through the injector above that needed for proper power output. This surplus of fuel returns to the main fuel-oil tank through the cross-flow lines and 5-lb. sight glass of the relief-valve assembly after cooling and lubricating the precision-made parts of the injector.

In the sight glass and relief-valve assembly the left-hand relief valve is set for 60 lb., the center for 100, and the right-hand for 5 lb. The adjustment must not be changed unless it is definitely wrong and then only by a competent maintenance man. The right-hand glass and valve passes the return fuel from the engine. A drop in the fuel level or an empty glass will indicate that the engine is not receiving its full amount of fuel. Air or gas will show up in this glass as bubbles.

The left-hand or 60-lb. glass will show fuel passing if either of the filters on the pressure side of the fuel pump collected enough dirt to build up a pressure of 60 lb., thus causing the fuel to by-pass the filters and engine and return to the tank. Under such circumstances close the globe valve between the relief valve and return line, again forcing the fuel through the dirty filters at a higher pressure. This will allow the engine to be operated until the maintenance point is reached and the filters changed or cleaned. If the cleaning of the filters is neglected and the back pressure increases to 100 lb., the fuel flows through the center glass and back to the tank by-passing the engine and resulting in loss of power as nothing else can be done except clean the dirty filters.

On each side of the unit is located a direct-reading sight-level gauge 4½ in. from the top. This gauge serves the purpose of checking its fuel level when refueling. The remote type aboard the unit serves the purpose of checking the actual gallonage remaining in the tank. This gauge is actuated by air at reduced pressure, forcing the fuel out of the tank pipe and exactly balances the weight of liquid in the tank. The indicator measures the air pressure necessary to balance the weight of the liquid in the tank and is calibrated to read the amount in gallons.

Trouble Shooting

The following are defects which can and might exist in the fuel system to interfere with proper operation of the Diesel engine.

If the fuel-pump motor is running but the pump is not delivering fuel to the 5-lb. sight glasses, check:

1—Supply of fuel in fuel tank.
2—Emergency fuel cut-off valve closed.
3—Broken fuel-pump shaft or loose coupling.
4—Leaking supply line.
5—Dirt lodged under relief valve.
6—Defective pump, pump seals or scores on either pump or housing.
7—Check suction filter gasket for leaking.

If electric motor is not running, investigate the following:

1—Are the fuel-pump switches on and in good condition?
2—Are fuses good?
3—Check the main battery switch.
4—Check the electrical connections at the motor.

Helpful Hints

1—The fuel-pump motor will labor when the filters in the delivery line are stopped up.

2—The fuel-pump motor will be unloaded with loss of fuel when, (a) emergency fuel cut-off valve is closed; (b) there is no fuel in the tank; (c) there is a leak in the suction line; (d) with loss of prime in the fuel pump.

3—A leak in the fuel delivery line will be noticeable by the loss of fuel, and if a leak exists between the fuel manifold and injector connection lube oil will be diluted with fuel oil. With the engine shut down, operate the fuel pump to find the leak in the fuel line.

4—If bubbles exist in 5-lb. sight glass with the fuel pump operating and the engine shut down, check for an air leak in the suction line. If they occur with the engine operating at maximum power, it indicates that the injector valve is allowing gases to pass into cross-flow fuel line. The defective injector check valve can be located by feeling the return line near the injector. If the line is hotter than normal, bar the engine over until the piston of that cylinder is below the scavenger ports. Operate the fuel pump with the injector rack disconnected and in full fuel position. Then inspect the crown of the piston through the liner ports for fuel accumulation.

5—Improper fuel supply to the injector will be indicated by loss of power. Check serve-motor piston at the governor and load regulator for correct loading.

Lubricating Oil System

The subject of lubrication is probably the most vital of all the details of a Diesel engine. The incorrect methods employed in handling good oils have been responsible for much of the trouble experienced in the operation. The Diesel engine, because of its extremely high operating temperature and precision machined parts, requires a good grade of lubricating oil. The system of lubrication of all Diesel engines fundamentally is the same and the fact that Diesel-engine crankshafts have been in service on locomotives making more than a million road miles with only .001 wear in crank bearings confirms the opinion as to the ability of the oil and the efficiency of the lubricating systems. It is true crankshafts, liners, pistons and other parts have been damaged by scoring, but there was always a definite cause and the major portion of such failures, if analyzed correctly, would be assigned to improver maintenance or operation, such as:

1—Failure to clean and flush the engine and lube-oil system properly after dilution (either water or fuel) or after the replacement of scored liners, pistons, bearings, or other internal damage.
2—Operating with too low oil pressure.
3—Water leaks from cooling system washing lubricant from piston assembly resulting, in some instances, in piston seizures.
4—Not cleaning engine-lube-oil system at stated intervals in accordance with manufacturer's recommendation.
5—Failure to handle oil in clean containers.
6—Operating engine with either high or low water-jacket temperature, high temperature causing oxidation (sludging) of oil and low temperature causing water, a product of combustion, to wash the lubricant from contact surfaces, resulting in wear at three times the normal rate.
7—The use of reclaimed oil other than in proportions covered in instructions.

Figure 2 is a fundamental drawing of the lubricating oil system of the EMD 567-A engine. The oil system consists of three parts: (1) the main-bearing pump, oil switch and relief valve; (2) the piston-cooling oil pump and "P" pipes; (3) the scavenger oil pump, strainers and oil separator.

The oil pan of the engine is large enough to hold the main portion of the lubricating oil of the oil system, classifying the engine as "wet sump." A bayonet type oil gauge is used to take oil-level readings which are as follows: System uncharged, system charged, high and low level. These readings can be taken with engine running or stopped. The capacity of the sump is 180 gal. To fill, pour this amount of oil into the filter basket

strainer. From here it will fill the oil-strainer chamber through the pilot hole. It will also flow into the engine oil pan. As a check on the amount of the oil entering the system, the oil level should be at the "uncharged level" on the bayonet gauge when 180 gal. have been added, after the system has been drained.

The Lubricating Oil Pumps

The two lubricating-oil pumps (piston-cooling and main-bearing) are combined in one unit mounted on the accessory end or pump end of the engine, with one suction line connected to the lubricating oil supply. The pumps are of the positive-displacement type and the pump rotors are helical spur gears. The piston-cooling portion of this pump has a capacity of 53 gal. per min. at 800 r.p.m. and delivers oil through the manifold to the bottom of each cylinder liner where a nozzle directs a stream of oil into each piston. The main-bearing pump has a capacity of 107 gal. per min. and delivers oil to the pressure lubricating system. When the engine is started, the pressure pump will pick up the oil from the bottom of the strainer chamber. This oil will provide an initial charge for lubricating the engine until the scavenger pump has refilled the strainer chamber. The scavenger pump has a capacity of 214 gal. per min. at maximum speed and is of the same type as the others. It is mounted on the lower part of the accessory-drive housing, draws oil through its oil screen and forces it through the Michiana filter and cooler back to the tank. A constant oil level is provided in the oil cooler on the cooler side of the oil dam. Oil flowing over this dam returns to the engine oil pan. This keeps the scavenger-pump suction pipe under oil and provides a "wet sump." The oil reading on the bayonet gauge should now be between the high and low level.

A spring-loaded relief valve is connected to the passage in the accessory drive housing through which the lubricating oil flows to the main bearing manifold. The spring pressure is adjusted by a regulating screw so that the lubricating oil enters the main manifold passage at the required pressure. However, the oil-pressure relief valve cannot be adjusted while the engine is running. It is normally set at 45 lb. An accurate check of its setting can be made by attaching a pressure gauge on the oil manifold on the opposite side of the engine. The main-bearing pressure gauge is connected to the oil line at the blower end (rear end) of the engine. Therefore, with the engine warmed up and operating at 800 r.p.m., this gauge should register only 30 lb. as there is a 15-lb. drop through the engine.

Protection Against Low Oil Pressure

The oil system is protected by a low-oil-pressure switch which consists of a spring-loaded diaphragm actuating a pair of electrical contacts. This low-oil switch should operate at 6 to 9 lb.; that is, it should pick up at 9 lb. and drop out at 6 lb. If this switch operates, it de-energizes the E master magnet valve and drops the engine speed to idle position. Under such circumstances the engine should not be run until the trouble is located and corrected. *The engine must not be run without low-oil protection.* To test this switch with the engine shut down, place the isolation switch on the engine instrument panel in run position. If the low-oil light comes on and the gong sounds, the switch is operating correctly.

If the main-bearing oil pressure drops below 20 lb. (at 800 r.p.m. hot oil), stop the engine and investigate. Look for stopped-up suction strainer in the tank, a stuck relief valve, broken oil lines, low oil viscosity, worn oil pump, loss of prime in pump, suction lines leaking and destroying the vacuum, or low oil.

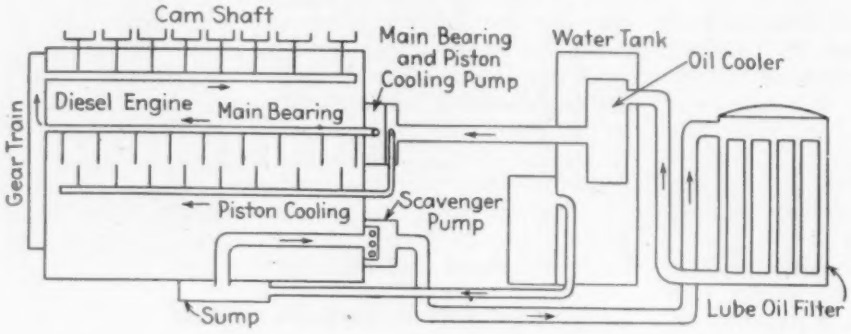

Fig. 2—Fundamental lubricating oil system for Diesel-electric freight locomotives

The piston cooling system has no relief valve or low-oil-pressure switch, so pressure is dependent upon oil temperature, viscosity and engine speed. Usually the pressure will 20-30 lb. at 800 r.p.m. and 4-8 lb. at idling speed with a warm engine. If pressure drops below 15 lb. (at 800 r.p.m. hot oil), stop the engine and investigate possible causes.

The oil separator is a unit mounted over the main generator. Air is drawn through this from the crankcase to the air-box blower intake. It is provided with a metal screen which condenses any oil from vapor which is taken from the crankcase. The condensed oil then returns to the oil pan or sump.

The lube-oil cooler is nothing more than a radiator located in the water tank. Its location there is in order that the oil temperature will be reduced to nearly that of the jacket water which is about 165 deg. Therefore, if the water-jacket temperature is properly controlled and the oil coolers are clean and functioning as they should, there should be no breakdown of the oil causing sludge formation or other oxidation products which are so detrimental to the Diesel-engine operation.

Keeping the System in Operation

Next to the selection of the proper oil is correct filtration and changing of oil at the schedule mileage recommended by the manufacturer. The condition of the lube oil between change-outs can be determined by analysis. The viscosity generally increases with service unless there is a dilution and it should be checked at maintenance point with Visgage each trip to determine its condition for further service. Periodically, oil samples must be taken and sent to the chemist for laboratory test for corrosive acid, and determination of flash, fire and precipitation number. The lubrication-oil suction strainers located in the tank should be cleaned each trip as the present Wastex used in the Michiana filter contains more lint than it normally did. This lint adheres to the

strainers. The Michiana oil filter contains four elements. Oil flows from around the outside of each element into a perforated tube at the center. In the base of the filter housing is a relief valve which is set to operate at 16 to 20 lb. The filter elements are made of Wastex which is packed tightly into perforated containers. These filters clear the oil of sludge and dirt but cannot remove any fuel oil or water which may be mixed with the lubricating oil. In servicing these parts, the presence of a black tarry substance collected on the lube-oil-tank suction screens or a badly purged Michiana filter pack indicates a water dilution of the lube oil and the engine must be held from service until the trouble is found and corrected.

If the lube oil begins to assume a dark or dirty color and it is otherwise correct, check to see if the Michiana filter elements are in place over the tubes at the bottom of the tank. If found to be in place, the color of the oil then indicates that filter elements should be changed at shorter mileage intervals.

Excessive oil consumption may be caused by a leak, broken or stuck rings, worn piston, excessive oil pressure, clogged oil drain hole in the piston or air-box blower seals leaking. The most of such defects will manifest themselves by excessive oil in the air-box drain tanks.

Little or no oil consumption may be due to water or fuel leaking into the oil.

Excessive wear in engine moving parts requiring lubrication will probably be due to the absence of lubrication when starting up. Water condensed on cylinder walls due to improper combustion or water leaking from cooling system by the head gasket or the seal and contamination of the oil due to ineffectual air or oil cleaners.

Cooling—Water System

The cooling systems of the various engines in the locomotive are independent of each other. They are similar to each other in every respect except that the first section (A units) have heater to heat the control room. Water is drawn from the water tank by centrifugal pumps located on the accessory end of the engine. The pump impellers are of the single-suction type and operate at 2,440 r.p.m. with engine speed of 800 r.p.m. and the combined capacity of the two pumps is 214 gal. per min. at that speed. These pumps draw the water from the tank which has a capacity of 245 gal. and circulate it through two tubular passages, one in each bank of the crankcase, which connects to the water spaces between the lower deck plates. From this section the cooling water enters the lower end of the cylinder-liner jacket and flows through the liner and through the cylinder head and from there it discharges into a water space along the upper section of each bank of the engine. The water is then discharged from this chamber into the water-outlet elbow connections to the four radiator sections located in the roof as shown in fundamental drawing Fig. 3.

The four cooling fans in the roof are driven from two speed increasers, one located at each end of the engine. The temperature of the water is controlled by the fans drawing cool air from the outside through the shutters. Closing the shutters restricts the air flow through the radiators and allows the water to heat up. Opening the shutters gives more air flow and causes the water to get cooler. The speed increasers are driven from the main shaft by friction clutches. These clutches are not to be engaged at above idling speed; to do so will seriously damage the driving mechanism. In cold weather, when difficult to control the engine temperature, it may be necessary to operate with one clutch disengaged. If this is done, it should be on the accessory end. On the generator end the fan circulates air through the high-voltage cabinet. After the water is cooled in the radiators, it flows down and through the oil cooler then into the water tank for reuse, thus completing the cycle.

Located on the water tank there is a water-level gauge. This should be full when operating. The engine should not be operated below the mark indicated on the gauge.

If the engine consumes water and there is no evidence of leaks in the cooling system it may be that a cylinder lower seal (either rubber or steel) is leaking or a head-to-liner gasket is leaking. In either event, the water will be going out with the exhaust in the form of vapor when the engine is running. Such leaks may be located by removing the cylinder test-valve packing with the engine working. Water will leak to the outside of the engine and be visible at the cylinder test valve.

Use Pure Water

Distilled water or rain water should be used in the cooling system to eliminate the accumulation of scale which contributes to engines overheating. Each cooling system is filled either through the filler pipe located on the roof above the water tank or through the filler alongside the fuel tank. The engine-water thermometer is located in the water tank and the temperature should be controlled at 165 deg. F. + or — 15 deg. An even temperature of 165 deg. F. is most desirable as combustion of the fuel is more complete, preventing moisture

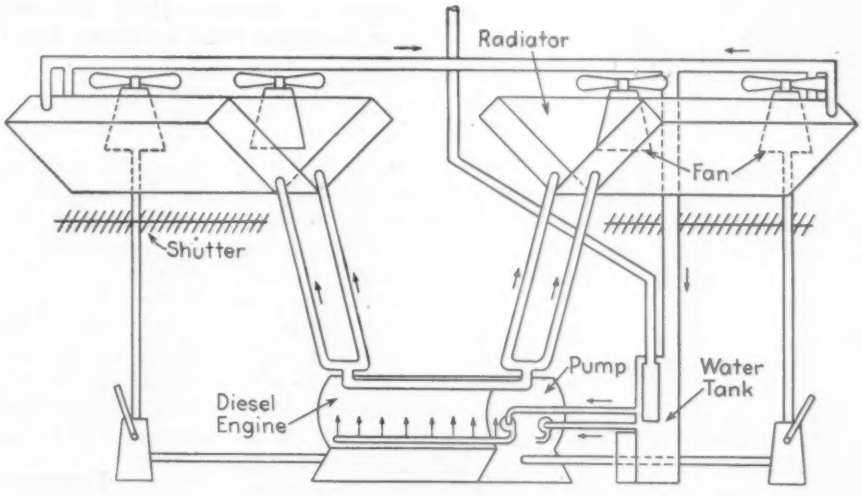

Fig. 3—Fundamental cooling system for Diesel-electric freight locomotives

and relieving the engine of the strain of expansion and contraction. Such strains contributed to cracked heads and liners and moisture washes away lubrication. Lack of lubrication will result in scoring and possible seizure of the piston in the liner. The cooling-system temperature can best be maintained with automatic shutter control. The gauge in the water delivery line should register 4 lb. at idling speed and 16 lb. at 800 r.p.m. with a clean cooling system. Greater pressure indicates obstruction. In checking for restriction in water circulation, the radiator header should be examined as the inner lining of the cooling system hose sluffs off and invariably lodges at that point. If the system is obstructed with scale it will be necessary to clean the entire cooling system as follows:

With the engine at approximately 400 r.p.m. and temperature 140 deg. F. to 180 deg. F., circulate a solution of Oakite penetrant in the proportion of three ounces per gallon of water for at least 30 min. to remove oil or grease. Drain this from the system and flush with clean water. Then with the engine idling and the temperature at approximately 140 deg. F., circulate a solution of 10 per cent Oakite No. 32 for not more than 30 min. Now drain the system, flush it once with clean water, circulate a solution of Oakite penetrant in the same proportion as before to neutralize the acidity. Fill the system with regular radiator water and test for acidity. If the test indicates no acid, then add one per cent of radiator compound R-3-7 to prevent erosion. The cooling system must be maintained free of water leaks as the use of hard untreated water will not only cause scale formation but the area exposed to high temperature will be subject to severe pitting. If the system is properly maintained it will be necessary to add water only at the maintenance point, where properly treated radiator water is provided.

An engine temperature switch is located by the engine instrument panel and connects to two thermal elements, one in each water outlet manifold of the engine. If the water temperature exceeds 200 deg. F. this switch closes, operating the signal relay which lights the hot-engine alarm light (red) and rings the alarm bell.

Never add cold water to a hot engine. If hot water is not available, crack the steam valve to the cooling system while water is added in small volume.

The cooling system is not protected with anti-freeze solution. If the system needs protection in winter weather and steam is available, open the two heater valves to the cooling system, also open the steam, the steam valve to toilet water tank, and steam generating equipment on B section. If steam is not available, then drain each of the systems to prevent freezing.

W. D. Quarles, Diesel master mechanic, A. C. L., is chairman of the committee.

Road Foremen Belong in the Cab

By Theo. Olson
Superintendent Motive Power, Chicago Great Western

Maintenance of close contact with work of road crews is needed—Best locomotive performance results when road foreman has time to teach men

The work performed by engine crews is such that it is important that each particular duty be performed in an exacting and proper manner. Any inefficient or neglectful work by engine crews will in one way or another cause not only unsatisfactory locomotive performance, but also additional expense. It would be difficult to evaluate exactly the effort and expense that may be warranted in training engine-service employees to reach a high degree of efficiency.

Irrespective of what system may have been adopted for the education of engine crews, undoubtedly it is recognized that most of the training or education in their particular field of work has been through more-experienced employees imparting their knowledge to their new and less-experienced associates. With the system in vogue on American railroads, all locomotive enginemen have worked for several years as firemen before being promoted to engineman. The time served as a fireman before being promoted to engineman may properly be termed a period of apprenticeship for the position of engineman. Enginemen are fully familiar with the duties of a fireman and consequently are qualified to instruct and train the firemen in their work.

It is evident that the type of practical training afforded new employees entering the service will depend largely on the qualifications and thoroughness in their work of the men operating the locomotives. An efficient and capable engineman will not tolerate careless and inefficient work on the part of the fireman. Such an attitude affords training that would be difficult to obtain in any other manner, provided the inexperienced employee is interested and anxious to learn.

Firemen Learn from Enginemen

The engineman's part in educating firemen in the proper performance of their duties is more effective when engine crews are regularly assigned and work together for a period of time. When an engineman has a different fireman on almost every trip the opportunities, as well as inclination, for training the fireman are limited. The system of having a regularly assigned fireman with an engineman is not nearly as common now as it has been

in the past due to changed working conditions, etc. Inasmuch as the present-day method of operation has minimized the opportunity for enginemen to educate the firemen, it is necessary that additional means be provided.

The training of enginemen in their work of handling locomotives, proper use of air brakes, supervision of firemen in proper performance of their duties, etc., and the training of firemen to obtain needed knowledge for promotion to engineman can be obtained only partially in a classroom or through the study of text books. Therefore, instructions must be imparted to enginemen and firemen while on the job by competent men who not only have a complete technical knowledge of the various phases of locomotive operation, but who are also able to demonstrate by actual performance the handling of locomotives as well as the art of firing. The necessity for such instruction and supervision has long been recognized and led to the appointment of road foremen of engines. These positions do not in all cases carry the same title, nor are their duties identical.

On railroad systems which do not have traveling firemen or supervisors performing similar duties, the road foreman of engines must ordinarily cover the entire field of supervising and instructing engine crews regarding the proper handling of locomotives and air brakes, the economical use of fuel through skillful handling of a locomotive and proper firing, and other duties pertaining to the work of engine crews. The road foreman, therefore, must be fully qualified himself in all phases of locomotive operation, including train handling and proper firing practices, in addition to having a thorough knowledge of locomotive construction, air brakes, and all appliances in use. Road foremen possessing these qualifications will be able to analyze and determine the causes of inferior performance, whether it be due to a condition of the locomotive or the crew operating it.

A Road Foreman's Duties

Inasmuch as the road foreman generally is the officer held responsible for the performance of engine crews in the handling and firing of locomotives and, perhaps, is the only officer assigned to instruct engine crews regarding their work, it would appear that the duties of the road foreman of engines, when no other supervisors are assigned in the field, should be principally as follows:

1—Riding with inexperienced enginemen and new firemen frequently and instructing them in the proper performance of their duties.

2—When there are no new or inexperienced men in the service, spend most of the time riding with and instructing the enginemen and firemen whose work is not up to average.

3—Analyze and make a prompt investigation of all engine delays and failures and discuss the reasons and the means for preventing recurrences with all enginemen. In making such investigations, it is frequently necessary to follow the engine to a repair point to make sure that authentic information is received. By discussing delays that have actually occurred and the proper methods of taking care of breakdowns, an impression will be left with the enginemen that will be remembered readily and enable them to handle similar situations in the future.

4—Keep familiar with methods of drafting locomotives and watch this phase of locomotive operation closely. Tremendous fuel waste occurs by improper drafting of locomotives. On the other hand, very satisfactory fuel savings can be made with free-steaming engines which are drafted properly, and which have stokers and grates in good condition, flues kept clean and free from leaks, front ends free from air leaks, etc. The maintenance forces at enginehouses have no definite means of knowing the road performance of locomotives except from reports received from road foreman or engine crews. In some cases reports from engine crews are not considered entirely authentic, and it is necessary for the road foreman to ride locomotives frequently enough, and check reports submitted by engine crews, to know whether or not there is any condition that needs correction in order to maintain maximum efficiency with reference to the steaming and fuel economy of his locomotives.

5—Hold meetings monthly at each important terminal to discuss current problems with enginemen. Meetings should stress the importance of fuel economy and the elimination of unnecessary black smoke which indicates fuel waste. Cases of fine performance by some men should be pointed out as an inducement for others to try to attain similar good performance. Make an effort to provide sufficient instruction literature to enable enginemen to keep fully posted on advancements made in the motive-power field and on air brakes.

6—While riding locomotives, make a thorough inspection of the locomotive and report any existing defects. Also, in the course of inspecting locomotives instruct enginemen and firemen how and where to look for defects and how to make a proper report of them. Keep a record of the condition of locomotives so as to be in a position to assist the mechanical-department officers in determining shopping schedules.

7—Keep a close and detailed check of the manner in which the engine crews perform their duties and how carefully the enginemen are watching important matters such as the maintenance of a proper water level in the boiler, the checking of boiler-feeding appurtenances, proper lubrication, proper functioning of air brakes and other matters essential to safe operation. Note what attention is provided the locomotive en route to prevent delays that can be eliminated, such as early attention to worn bearings, and delays in cleaning fires. By studying the work of the engine crews road foremen will soon be in a position to know where supervision is most needed. Careful observations should also be made as to compliance with existing operating rules and, if violations are noted, prompt and corrective measures taken.

Don't Overlook Road Foremen

There may be a number of other duties that road foremen are expected to perform. Nevertheless, if the territory to which a road foreman is assigned and the number of employees to supervise is sufficient to occupy his time in carrying out the duties mentioned, further duties should not be imposed on him. His time should be spent primarily in riding locomotives and supervising the men at their work. It cannot be expected that full knowledge can be obtained of the qualifications of the men or the performance of the locomotives merely by meeting engine crews at terminal points for a brief interview or a casual inspection of the locomotives. Neither are best results obtained by merely holding a post mortem after irregularities have occurred, whether it be regarding an engine failure, drawbars pulled, poor train handling, or failure to make schedule time. While investigation of such irregularities is essential, it is certainly preferable to make every possible effort to educate the enginemen to the extent that avoidable irregularities are eliminated. To accomplish this, a road foreman must spend his time with and among the men on the road.

The road foreman's work is such that it requires capable men interested in their work and willing to devote their full time and attention to their duties. However, it is an interesting field of activity and pays ample returns on properly directed efforts.

G. B. Curtis,
Chairman

How To Get Rid of Black Smoke

What one road did to its locomotives and the results achieved — Over-fire steam-air jets an important factor

Black smoke emitted from the stacks of locomotives indicates either carelessness on the part of one or both members of the crew, improper design of locomotive grates, ashpan, draft arrangements, or the improper maintenance of the locomotive.

It is a well-known fact that black smoke is combustible and is a waste of a very important commodity necessary to the promotion of transportation and the living conditions of the American people. We all know that it requires the proper amount of air heated to the proper temperature, with a supply of fuel, to produce combustion and when too little or too much air is supplied to the combustion area and temperatures are not brought up to the proper point a part of the fuel, volatile carbon, will be emitted from the combustion area as black smoke. Even after applying to the locomotive all of the modern devices known to aid combustion, we still have the human element with which to deal in the elimination of black smoke and, if the engineman and fireman do not cooperate and use good judgment, we will still have excessive smoke from our locomotives.

One Road's Experience

Until about fifteen years ago our locomotives were equipped with the Master Mechanic's front end and with a ½-in. nozzle for each inch of cylinder. They were also equipped at that time with extension stacks running to 18 in. or 20 in. above the nozzle tip, which was the Goodfellow type. Most of our locomotives were then running with an open arch—that is, we were using toe brick between the arch and the throat sheet.

After extensive experiments, we increased the size of the nozzle on the engine with 26-in. cylinders to 8 in., using a cross-bridge on the nozzle, or what is commonly known as the spreader type nozzle. We lowered the extension stack to within 14 in. of the nozzle tip and took the toe brick out of the arch, making what we refer to as a sealed arch. This greatly improved the conditions in the combustion area of the firebox of the locomotive and reduced the amount of smoke to a minimum while the engine was working steam.

We still had difficulty in keeping down smoke while the engine was standing at terminal or on the fire tracks due, in my opinion, to not getting enough air through the fire bed into the combustion area. This, of course, brought up the idea of inducing over-fire air into the combustion area and, at the invitation of a neighboring railroad, which had made an extensive study of over-fire air induction tubes, I rode an engine of this railroad and, with the co-operation of the mechanical department of our own railroad, we equipped a Mallet type engine, which was used in hump service in the yard, with the over-fire air-jet induction tubes. These locomotives are of the 2-8-8-2 wheel arrangement and have a 17-ft. firebox with the Gaines fire wall set back 3 ft. from the throat sheet. They were not equipped with an arch and were fired with duplex stokers.

It was almost impossible to fire these engines in hump service without making objectionable smoke and we, like all other railroads, had to use any one we could employ as firemen. Five of the airjet tubes were installed on each side of the firebox, these tubes being equipped with a silencer which cut down to some extent the noise from the steam jets while they were working. The operation of the jets was interlocked with the operation of the engine blower with a cut-off valve at the turret. Tests were made after this locomotive was equipped with the steam jets without an arch and pictures were taken by smoke abatement engineers of the District of Columbia. One picture was taken after the engine was fired up which showed a No. 5 smoke. The steam jets were then put in operation and another picture was taken less than thirty seconds after the jets were put in operation and showed practically a clear stack.

We found, however, that some of the men who had been enginemen so long that they had become set in their ways objected to the noise of the steam jets and, while the noise was not any more than the stoker would make, they insisted on the fireman shutting these jets off when there was no supervisory force around.

To overcome this trouble with crews failing to operate these jets at all times when the locomotives were being fired, the operation was interlocked with the stoker and the blower and the extension handle taken off the supply pipe at the steam turret.

A fireman with a few days' experience and a little care can operate the stoker continuously for several minutes, or as long as is necessary to maintain full steam pressure and not make more than a No. 1 smoke.

We have now equipped these engines with brick arches and they can be fired with absolutely clear stacks.

After meeting with successful performances of the steam air jet on this type of engine, we had ten new passenger engines, which were being built for us by the Baldwin Locomotive Works, equipped with the blowers hooked up with the steam jets and have an arrangement whereby the jets may be used from the house blower, this being of material benefit in firing engines up in the house. We are also equipping our other locomotives in this manner as fast as they go through the back shop. All of our road engines are equipped with sealed arches and the new draft appliances referred to above.

Our instructions to firemen are to use the scoop in preparing locomotives for the run, using the blower lightly, which, of course, brings the over-fire jets into service.

Skilled Firing Still Needed

For road operation smoke abatement and maintaining a hot engine with the least quantity of fuel is largely a

matter of timing by the firemen. Over-feeding of the fire is often the result of the fireman's failure to note the changes in the cut-off made by the engineman, increasing or decreasing the demand on the boiler. His failure to increase or decrease the amount of coal required to maintain full steam pressure results in smoke emissions.

In some cases where safety valves are allowed to raise due to the fireman not exercising the proper judgment in feeding the right amount of coal to the fire, he will shut the stoker off a few seconds too long, which will allow the firebox temperature to be reduced to where smoke would be made while attempting to gain the lost steam pressure. Any change in the demand for steam output by the boiler should be noted promptly by the fireman in order that he may change the amount of coal to be fed to the fire and maintain a uniform steam pressure.

In case of yard firing, engines equipped with over-fire air-jet tubes can be fired with a No. 1 or less smoke by the use of the horseshoe bank—that is, firing heavily around the sides and back sheet, having the fire light in the center of the firebox where the temperature is the highest.

Supervisory forces should start giving instructions on smokeless firing to a new fireman the day he starts his student period as a fireman and they should be impressed upon him at every opportunity.

The chairman of the committee is G. B. Curtis, road foreman engines, R. F. & P.

Getting More Service from Locomotives

Time at terminals and enginehouses must be reduced—Many facilities needed—Scheduled maintenance for steam power pays dividends

A. A. Raymond,
Chairman

Suggestions have been solicited from leading men on the various railroads as to what, in their opinions, will aid in obtaining maximum utilization of locomotives. Their suggestions are summarized in the report of the Committee on Utilization of Locomotives and include the following: use of all locomotives in pool service; extension of engine runs; the use of combination-type, freight-and-passenger locomotives; and the purchase of locomotives to the latest design specifications which are roller-bearing equipped, are built of high grade materials throughout, and have cast-steel beds, stokers, and lubrication systems of adequate capacity with lubrication from forced-feed lubricators to all parts requiring it. These locomotives should all have large-capacity tenders and ashpans. Proper water treatment is regarded as essential in obtaining the utmost in service from all locomotives.

Another feature to be dealt with is the spacing and location of water, fuel, sand and ash-dumping facilities. It is suggested that these facilities should be built so that all servicing can be done at one point in a minimum length of time. This requires high rates of delivery for fuel and water—40 tons of coal and 5,000 gal. of water per minute being suggested as the lowest figures which should be considered.

Cutting Terminal Time

A number of things were suggested which would have an appreciable effect in cutting down locomotive terminal time. Locomotives should be inspected immediately upon their arrival. Auto-gas station type lubrication requires locomotives with complete installations of Alemite-type fittings. Hot washing and filling systems are needed for boilers. There must be adequate equipment for dropping wheels, all drivers at once if necessary, and complete engine and trailer trucks. Overhead and portable lifting facilities are needed, and wheel-storage tracks with handling equipment of adequate capacity should be located at a convenient, nearby point.

Enginehouse machine shops must be tooled so that needed work can be done quickly. Equipment and facilities must be provided so that necessary work on rod bushings, springs, etc., can be done in the shortest possible time. Proper lighting is essential to the best work and enginehouses and inspection pits should have it. Ash pits should be located so that they are easily cleaned without delaying locomotive movements. In the northern districts it will be necessary to have enough snow-handling equipment to keep the terminal territory clear. Thawing equipment for locomotives, frozen cars of coal and coal pockets is also needed.

Out-of-service terminal time can be reduced by using road freight engines in idle hours for yard switching and by servicing switching locomotives during the crew lunch periods.

Enginehouses often have too many stalls and get to be graveyards; fewer stalls and good enginehouse equipment will keep the engines on the road and working.

Such conditions automatically increase between-shop mileage and lead to higher standards of maintenance. Some locomotives have been reported as running 2,500 miles before being held for special inspection and necessary adjustments. Through runs which have been reported are 482, 771, 1,221, 1,430 and 1,506 miles.

Planned Enginehouse Handling

Here are several examples of good handling:

In the first case, a locomotive arrived which had a driving spring requiring replacement. Three hours later it left with a train; the driving spring had actually been renewed in one hour and thirty minutes.

In another case a locomotive was given a regular monthly inspection and left with a train twelve hours after arrival.

In the third case, an arriving locomotive was in for a quarterly inspection. In addition to washout and other regular attention, it required the renewal of three side-rod bushings and four knuckle-pin bushings. Nineteen hours after the locomotive's arrival it left with a train.

Planned Maintenance Pays Huge Dividends

In a detailed study made between a locomotive receiving routine maintenance attention and use and one where intensive utilization was aimed at under careful daily supervision with planned maintenance procedures, the figures shown in the table were developed:

The Effect of Planned Maintenance Procedure

	A year's general operation		Planned and closely supervised operation	
	Hrs.—Min.	Per cent	Hrs.—Min.	Per cent
Total time	8,760— 0	...	1,379—07	...
Enginehouse time	5,187—35	59.2	366—40	26.6
Time on road	3,572—25	40.8	1,012—27	73.4

The figures indicate that time at enginehouses can be reduced about 50 per cent if all locomotives could be handled in the same manner as the test locomotives were handled; that is, by careful daily supervision of their use and the following out of planned maintenance procedures. The figures for general operation given above, when broken down, showed that the average engine was held at intermediate terminals for work on rods, valves, pistons, crossheads, wheels, boxes, spring rigging and engine-truck equalizers. Using planned maintenance procedures the 50 per cent saving in enginehouse time can be realized because necessary work on locomotives is anticipated by enginehouse forces.

Fundamental Facts About Utilization

The Railway Age of February 5, 1945, effectively summarizes some of the principal points relative to utilization as follows:

1—In comparison with the Diesel-electric for road service, the steam locomotive has at least four handicaps. These are (a) the greater frequency of stops for coal and water; (b) the time required for fire cleaning and ashpan dumping; (c) the smoke and cinder nuisance, and (d) boiler maintenance.

2—The employment of large-capacity tenders and of auxiliary water cars has greatly reduced the handicap of service stops as an interference with the continuity of train movement. The provision of main-line coaling stations and water cranes is also contributing to the reduction of this interference.

3—It has been demonstrated on numerous occasions that fires can be maintained almost indefinitely with some fuels, but as long as coal is burned on grates, the ashpan must be dumped. Dumping can be done when coal and water are taken without adding further delay.

4—The locomotive boiler was the source of the greater portion of the labor and expense of maintaining locomotives until the advent of water treatment, seal welding of tubes in back tube sheets and the welding of inside firebox sheets which effected a revolution in locomotive maintenance and machinery repairs took the lead. However, improvements in running gear, roller bearings, etc., has reduced machinery maintenance and the boiler has resumed its former lead.

A. A. Raymond, superintendent fuel and locomotive performance, N. Y. C., is chairman of this committee.

Handling Heavy Passenger Trains

Starting the train without shocks—Technique of slowing down and stopping, including use of independent brake and graduated release

Frank C. Goble, Chairman

The subject of passenger-train handling is of special interest to those who make the rules and should be to the ones who are to execute them. It requires a great deal of practice and good judgment to do a job of smooth train handling.

In the first place, the engineman should know that the locomotive, whether steam, Diesel, or electric, in his charge is in a satisfactory condition for service and that the air pressures are correct and that proper tests have been made to assure that the devices are operating as intended.

After coupling to the train and having the brake system charged to at least 70 lb., a 15-lb. reduction should be made and brake-pipe leakage noted and reduced to its minimum but at no time to exceed 7 lb. per min. After the inspection of brakes is completed, the engineman should be notified as to their condition by the inspector or employee making the inspection.

When the signal to start is given, the train must be started slowly. This requires great care. An engine must not be allowed to accelerate too rapidly during the time a train is being started. As each car is moved it is brought from a speed of zero to that corresponding to the engine and this difference must be as slight as possible. Smoothness must not be sacrificed to save time.

Running Test

On a passenger train, on leaving an initial terminal or any other point after the engine or engine crew has been changed or an angle cock closed, except for cutting off cars or engines from the rear, a running test of the brakes must be made as soon as speed permits. Such test should be made by applying the brakes with a total brake-pipe reduction of 15-lb. or more to ascertain whether they are operating properly. The engine brakes should not apply. Steam or power should not be shut off

unless conditions require it. In case the brakes do not operate properly in this test, the signal for brakes must be given.

Stopping—Electric or Diesel Locomotives

When stops with electric or Diesel locomotives are anticipated, power may be shut off or used. If power is shut off before making the initial reduction, ample time must be allowed for the slack to adjust itself. If the initial reduction is made before shutting off the power, it may be continued until pressure is indicated on the brake-cylinder gauge; then place brake in lap position. To explain this, the engineman will use power approaching a station and make a 10 to 15-lb. brake-pipe reduction before shutting off power, the object being to keep the slack stretched while the brakes are applied; also to permit a heavier reduction being made while the speed is high which effects rapid deceleration. Further reduction (not to exceed 25 lb.) may be made to reduce speed; then the brakes graduated off.

Stopping—Steam Trains

On steam engines where power is used to the point of making a service brake application for a stop, its use should be continued until the brakes have been applied and the speed reduced when the throttle should be gradually closed or moved to a drifting-throttle position.

Power Breaking

When necessary to make a slow-down, such as at draw bridges, curves, etc., it should be made while using power, keeping the locomotive brake released. Before passing the point of slow down the train brakes should be fully released and, if necessary, the throttle eased off to a slight pulling throttle so that the speed will not be materially increased over the distance of the slow down or curve. With present day schedules, it is impossible to drift all slow downs at required speeds without loss of time; therefore, power braking is the preferable method. If the locomotive is equipped with a speed indicator, an engineman can comply with all the slow downs at the required speeds. For example, if the speed restriction requires a given speed of say 50 m.p.h. and the speed aproaching that point is 70 m.p.h., the engineman should make a brake application of not less than 15 to 20 lb. and brakes should be released at a speed of 5 to 10 m.p.h. above the permissible speed required for point of slow down.

Graduated Release

When engines are equipped with ETEL or combined automatic and straight air brakes and the graduated release feature is operative on the cars, the brakes should be partially graduated off before stopping, provided the reduction total is 15 lb. or more, until brake-pipe pressure is restored to within 10 to 12 lb. of feed-valve setting. The reason an attempt should not be made to graduate the brakes off after the brake-pipe pressure is built up to 100 lb. is that there is a liability in time to retain pressure in brake cylinder. For the same reason it is not advisable to attempt to make a graduated release if only a 10-lb. brake-pipe reduction has been made.

To effect graduations the brake-valve handle should be manipulated between lap and running or holding positions with the No. 6 ET equipment. With steam locomotives equipped with No. 8 ET equipment it has proved very successful to place the independent brake-valve handle in lap position to retain a pressure of at least 30 lb. in the brake cylinder prior to making graduations of the train brakes. This procedure will permit the closing in of slack on the head portion of the train (say, a car or two). By using this method it is seldom necessary to take the slack when attempting to start a heavy train.

Consideration must be taken as to length of time the brake-valve handle should remain in running or holding position in order to effect graduation on the last car of the train. With trains composed of eleven or more cars, brake-pipe pressure should be increased 5 lb. on the first graduation and approximately 3 lb. for each subsequent graduation.

Two-Application Stop

For a two-application stop the brakes should be applied with an initial brake-pipe reduction of 7 lb. unless power is being used, when the initial reduction may be increased to 10 to 15 lb., followed by further reductions not to exceed a total of 25 lb. If necessary to reduce the train speed to 10 to 15 miles per hour, the brakes should then be released by placing the brake-valve handle in running position for at least 10 sec. (more than seven cars, 15 sec.) before starting the final application. The final application should be made with a brake-pipe reduction of 10 lb. or less.

After the stop is completed, the reduction should be continued until a 15-lb. reduction has been made in order to assure a release of all brakes.

The Independent Brake in Passenger Service

The independent brake may be used to bunch slack, control speed or stop, but when used it should be applied gradually and as lightly as possible.

The ideal stop with the independent brake is accomplished when the engine brake is graduated off and final release occurs just as the train comes to a stop, unless on a descending grade, when a light brake-cylinder pressure should be retained.

Taking Slack

When it is necessary to take the slack to start, take it on only two or three cars. Should this fail to start the train, take the slack off the entire train and, when conditions require, apply the train brakes, holding the engine brake off, using power until the train stops. After stopping, place the reverse lever in forward motion. Make sure the brakes are released and start carefully, stretching the slack slowly until the entire train is in motion.

Training New Enginemen

These instructions cover the handling of passenger trains so that it will be agreeable and comfortable for those who are riding them. Every road has its particular method of handling air-brake equipment and if that method is satisfactory, it is the proper method to use. When rules are made, it is a supervisor's job to see that they are complied with. By giving the men proper instructions and demonstrations we can accomplish this, but we must depend largely on the judgment of the engineman in handling because of the different make-up of trains, etc.

On one of the eastern railroads it has been the practice for the past eight years to have a road foreman of engines or first-class engineman supervise a fireman for his first three trips after he is promoted to the position of engineman or until he is found competent in third-class service. This procedure is followed for both second- and first-class service. With this method we feel the engineman has received sufficient practical instruction in the requirements of his duties.

Frank C. Goble, general air-brake instructor, New York, New Haven & Hartford, is the chairman of this committee.

Locomotive Maintenance Officers' Association

Employee suggestion systems, air brake, welding and heat treating reports in program

LIKE the other mechanical associations the Locomotive Maintenance Officers' Association did not hold any meetings during the year just passed but did greatly expand the work of its technical and other committees. In the pages which follow there will be found a group of comprehensive reports which have been developed as a result of the work of the committee on employee relations, welding, forging and heat treating, maintenance of air brake equipment, shop tools, and the maintenance of Diesel-electric locomotives. Two other committees of the association, the lubrication committee and the committee on improved maintenance practices, were not able to complete their reports in time for inclusion in this issue.

The report of the committee on employee relations and supervisory training has, as a result of contact with a number of railroads, compiled a report dealing with the results that have been secured with employee suggestion systems and the organization required in carrying on this type of effort. The welding report deals with a number of advanced ideas in welding practices developed, in many cases, in builders' plants, that may be adapted to steam locomotive practice. The forging and heat-treating report presents, probably for the first time, a "manual" of heat-treating, forging and flame hardening practice for the guidance of railroad shop men in that field of work. The air-brake report, as in past years, deals specifically with the maintenance practices and tool equipment required in overhauling a single item of equipment —in this case brake-pipe vent valves. The shop-tool report is a progress report on the use of modern cutting tools for the machining of locomotive parts, and the Diesel maintenance report deals exhaustively with the work that must be performed in the routine maintenance of that type of motive power.

There having been no election of officers during the past year the affairs of the association continue in the hands of the same men as in 1944.

W. H. Ohnesorge, Chairman

Forging, Heat Treating and Flame-Hardening Locomotive Parts

Report embraces material specifications, method of manufacture and heat treatment of a large variety of locomotive parts

This subject has been discussed by many organizations in the past and as a result there are many excellent text books some of which are highly technical while others are very general. None, however, treat the subject from a railroad standpoint. It is, therefore, the intention of this committee to develop a paper covering this subject that can be used by any railroad shop and if followed the user can feel assured that results will be satisfactory.

The information has been compiled from questionnaires that have been returned by leading railroads throughout the United States.

In order that we may all have the same understanding of terms used, it may be well to state a few definitions based on American Society for Testing Materials.

Heat Treatment.—An operation or combination of operations involving the heating and cooling of metal or alloy in the solid state for the purpose of obtaining certain desirable conditions or properties. (Note: Heating and cooling for the sole purpose of mechanical working are excluded from the meaning of this definition.)

Annealing.—A heating and cooling operation implying usually a relatively slow cooling. (Note: Annealing is a comprehensive term.) The purpose of such a heat treatment may be: (a) To remove stresses; (b) to induce softness; (c) to alter ductility, toughness, electrical, magnetic, or other physical properties; (d) to refine the crystalline structure; (e) to remove gases and (f) to produce a definite micro-structure.

In annealing, the temperature of the operation and the rate of cooling depend upon the material being heat treated, and the purpose of the treatment. Certain specific heat treatments coming under the comprehensive term annealing are: (a) Full annealing-heating iron-base alloys above the critical temperature range, holding above that range for a period of time, followed by slow cooling to below that range. (Note: The annealing temperature is generally about 100 deg. F. above the upper limit of the critical temperature range, and the time of holding is usually not less than one hour for each inch of section of the heaviest objects being treated. The objects being

Temperatures for Normalizing and Tempering Locomotive Forgings

Carbon	Manganese	Vanadium	Nickel	Normalizing temperature deg. F.	Tempering temperature deg. F.
0.45-0.45	0.50-0.85	.....	.....	1,500-1,550	1,000-1,100
0.45-0.50	0.50-0.85	.....	.....	1,475-1,525	1,100-1,250
0.50-0.55	0.50-0.85	.....	.....	1,450-1,500	1,200-1,350
0.45-0.50	0.70-0.95	0.15-0.25	.....	1,575-1,650	1,050-1,250
0.50-0.55	0.70-0.95	0.15-0.25	.....	1,575-1,650	1,050-1,250
0.35-0.40	0.50-0.80	.....	3.25-3.75	1,425-1,450	1,000-1,150
0.40-0.45	0.50-0.80	.....	3.25-3.75	1,400-1,425	1,050-1,200
0.20-0.30	0.80-1.00	.....	2.30-3.00	1,425-1,475	1,000-1,200

treated are ordinarily allowed to cool slowly in the furnace. They may, however, be removed from the furnace and cooled in some medium which will prolong the time of cooling as compared to unrestricted cooling in the air.)

Quenching—Rapid cooling by immersion in liquids or gases, or by contact with metal.

Normalizing—Heating iron-base alloys to approximately 100 deg. F. above the critical temperature range, followed by cooling to below that range in still air at ordinary temperature.

Case Hardening—A heat treatment or a combination of heat treatments in which the surface layer of an iron-base alloy is made substantially harder than the interior by altering its composition (carborizing or cyaniding, both of which are ordinarily followed by quenching, or by nitriding).

Flame Hardening—A process which embraces the use of the oxy-acetylene flame to raise the temperature of the surface of ferrous metals (iron and steel) so that subsequent quenching will produce a desired hardness and structure.

This process furnishes a hardened case on the surface of the parts being treated without altering the chemical composition. It must not be confused with such processes as carburizing, cyaniding, or nitriding that require an addition or absorption of other elements.

Critical Point—Critical Range—Reference: Metals Handbook, 1939 Edition. Page 366, subject "Constitution of Iron and Carbon Alloys," which gives a very satisfactory explanation of this subject.

Shop Equipment Needed

The following equipment is recommended to give the most satisfactory results from a heat-treating and financial standpoint.

Furnace Type—The car bottom furnace is recommended for all work requiring normalizing and tempering because by removing the car bottom it is more accessible for loading and unloading and assures proper blocking of work. The furnace should be constructed with a door at each end so that it also can be used for preheating billets for flame cutting.

A cooling shed should be located at one end of the furnace and the flame cutting house at the other end. This would permit normalizing without interfering with the flame cutting machine.

A solid bottom furnace is better for case hardening because parts requiring the greatest depth of case can be put in first, and those requiring a lesser case can be more readily removed without disturbing the furnace heat to any great extent. Also, a table should be constructed at the door of the case hardening furnace upon which pots can be placed when removed from the furnace.

Metal Container for Pack Carburizing—These should be made as light as possible from high temperature alloy sheet or plate, resistant to scale and corrosion and capable of rapid heat penetration in order to come up to required temperature quickly. The size and shape of the containers depends upon requirements. The seams should be properly welded and given a pressure test to prevent gas from escaping.

Gas Carburizing—A commercial electric furnace is recommended with a controller that regulates the temperature of the furnace, distributes the heat uniformly throughout the load, keeping the temperature uniform, as required, and feeds a constant amount of fluid to generate carburizing gas of definitely-controlled quality. Also, a chart giving necessary information to insure satisfactory results is desirable.

Liquid Carburizing—A pot type furnace is recommended (gas, oil, or electric, depending on local conditions) with automatic temperature controls, and a suitable quenching bath located adjacent to the furnace. Automatic control is recommended and most desirable because it requires less attention, insures a more even heat, and should give better combustion.

A recording pyrometer should be used for heat treatment, and an optical pyrometer for forging, and for work where a recording pyrometer is not necessary.

Medium of Quenching—This refers to the rapid cooling of a metal, usually, but not necessarily, by immersion in a liquid. There are two universally used liquid quenching media; namely, water and oil. The use of a cold bath to shorten the life of vapor formations and agitation such as in the submerged spray quench are recommended. The addition of common salt or sodium hydroxide will destroy the stability of vapor films and permit early cooling. Nine per cent common salt, or three per sent sodium hydroxide has been found to give maximum efficiency.

Shape Cutting—High-carbon steel (0.40-0.55 per cent) must be preheated and 3/8-in. stock or more must be left for machining to eliminate possible surface cracks and change in structural composition.

Heat Treating Locomotive Parts

The specifications referred to in this report will be A. A. R. or S. A. E. These specifications are standard throughout the country, and copies are available to all railroads.

The following data covering recommended practices are from replies to questionnaires received from several railroads.

For general guidance, the temperatures recommended by the American Society for Metals are included in an accompanying table. These figures are based on a single normalizing treatment with slow cooling in the furnace from the temperature. These temperatures may need modification to meet individual requirements.

Links (When Flame Hardened)

Specifications: AAR-M-105. Class A. Grade 3.

Method of Making: (1) Shape cutting. Recommended due to low cost of making. Care should be taken when ordering billets to procure proper size in order to eliminate waste.

(2) By forging. Recommended only when no shape cutting machine is available.

Heat Treatment: (1) Normalize; (2) Temper; (3) Flame-harden.

After links have been machined the link block wearing surface is then flame-hardened.

Note.—When links have been made out of AAR-M-105 Class A, Grade 2 and it is desirable to flame-harden, they may be heat treated as follows:

(1) Normalize; (2) Carburize. After links have been machined they should be carburized as follows: Pack links in metal containers using commercial carbonizing compound and seal the cover with fire clay to prevent gas from escaping. Place the containers in the furnace and heat for approximately 20 hr. (time depending on the depth of case desired). Allow links to cool in containers before removing.

Note.—As low-carbon steel can not be flame-hardened it is necessary to carburize before flame-hardening. (3) Flame-harden. After links are carburized flame-harden the link block wearing surface.

Links (Not Flame Hardened)

Specification: AAR-M-105, Class A, Grade 2.

Method of making: (1) Shape cutting recommended. (2) Forge, when shape cutting machine is not available.

Heat treatment: (1) Normalize; (2) Carburize. After links have been machined they should be carburized and allowed to cool. (3) Quenching. Reheat links and quench.

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1944-1945

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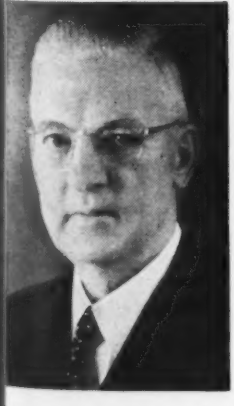


J. Roberts

O. A. Garber

D. J. Sheehan

Link Blocks

Specifications: AAR-M-105, Class A, Grade 2.
Method of making: Forge in slabs approximately four blocks to the slab.
Heat treatment: (1) Normalize; (2) Carburize and allow blocks to cool. (3) Quenching. Reheat links and quench.

Eccentric Rods

Specifications: AAR-M-105, Class A, Grade 3.
Method of making: Forging recommended. However, good results can be attained by forging and shape cutting.
Heat treatment: (1) Normalize. (2) Temper.

Combination Levers

Specifications: AAR-M-105, Class A, Grade 2.
Method of making: Forging recommended.
Heat treatment: Normalize.

Valve Rods

Specification: AAR-M-105, Class A, Grade 2.
Method of making: Forging.
Heat treatment: Normalize.

Valve Stems

Specifications: AAR-M-104, Class A.
Method of making: Economy suggests the use of scrap piston rods provided they meet the above specifications and they should be made by the forge-and-draw method instead of the upsetting method in order to eliminate cracks at the collar when upsetting.
Heat treatment: (1) Normalize. (2) Temper. (3) Test specimens—A specimen should be taken from one valve stem representative of a group. If the specimen meets the requirements the stems can be accepted for use.

Union Links

Specifications: AAR-M-105, Class A, Grade 2.
Method of making: Either by forging or forging and shape cutting.
Heat treatment: Normalize.

Radius Bars (One-Piece, Not Flame Hardened)

Specifications: AAR-M-105, Class A, Grade 3.
Method of making: Either by forging or shape cutting or by a combination of these two methods.
Heat treatment: (1) Normalize. (2) Temper.

Radius Bars (Two-Piece, Flame Hardened)

Specifications: AAR-M-105, Class A, Grade 3.
Method of making: Forging.
Heat treatment: (1) Normalize. (2) Temper. (3) Flame-harden. After machining and cutting oil grooves in the tongue, flame-harden on the top and bottom.

New Main and Side Rods

Specifications: AAR-M-105, Class A, Grade 3.
Method of making: Forge and shape-cut the ends.
Heat treatment: (1) Normalize. (2) Temper. Each forging should be tested, by specimen, to make sure that it meets requirements.

Repaired Main and Side Rods

All rods should be Magnafluxed and cracked rods rejected. Worn surfaces, such as bushing eyes, sides of forks, etc., may be built up (when permitted) by electric welding, as follows:

(1) Rods which are to have surfaces built up are first preheated slowly on open fire of briquettes so that the heat extends well beyond the surface to be welded. The work is to be protected against drafts. The briquette fire is to burn under natural draft only. The temperature of preheating need not exceed 300 deg. F. to 500 deg. F. and must not exceed 800 deg. F., that is, not above black heat. Probably the temperature of the briquette fire is not above 800 deg. F.

(2) Welding is to be done by the electric process only, and by approved methods for building up metal. The work is to be properly protected and the rod cooled slowly.

(3) All rods repaired by welding (when welding is permitted) should either be re-heat-treated or stress-relieved. If stress-relieved only the temperature should not exceed the draw back or tempering temperature.

(4) If straightening the rod is necessary or fork eyes need closing or opening the rod may be heated locally for that purpose by an oil flame in the portion to be altered. The temperature should not exceed the tempering temperature in any case—preferably not to exceed 1,100 to 1,175 deg. F.

(5) After straightening, the rod should be allowed to cool with proper protection.

Brake and Spring Rigging Parts

Note.—This applies to such parts as slack adjusters, pull rods, equalizers, etc.
Specifications: AAR-M-105, Class A, Grade 2.
Method of making: Forging and shape cutting.
Heat treatment: Normalize.

Brake Beams, Driving Box Equalizers, Etc.

Specifications: AAR-M-105, Class A, Grade 3.
Method of making: Forge and shape cut.
Heat treatment: (1) Normalize; (2) temper and (3) flame harden. Driving box equalizers flame hardened at box pit. Brake beams flame-hardened at hanger bearings or trunnion ends.

Brake Rigging and Spring Rigging Pins

Specifications: AAR-M-106, Grade B.
Method of making: These can either be forged or machined depending upon equipment and cost of making. However, a better case hardening can be obtained with a machined pin.
Heat treatment: (1) Carburize; allow pins to cool and (2) quenching; reheat pins and quench.

Brake Rigging and Spring Rigging Bushings

Specifications: S.A.E. 1020.
Method of making: Bushings can be machined from tubing.
Heat treatment: (1) Carburize; allow bushings to cool and (2) quenching; reheat bushings and quench.

Binders—Frame or Pedestal Caps

Specifications: AAR-M-105, Class A, Grade 3.
Method of making: Recommend shape cut, although some roads purchase heat-treated billets from which binders are machined. This method eliminates heat treating.
Heat treatment: (1) Normalize. (2) Temper.

Note: When locomotives come into the shop for repairs and it is found that wear has occurred at the pedestal fit the binders or pedestal caps may be repaired by metal spray process as follows:

Clean binders or pedestal caps at lye vat, then jack in place on frame, using feelers to determine the amount of wear and mark the wear.

Remove binders or pedestal caps and sandblast surfaces that are to be built up, making sure surfaces are clean. Do not touch the fit with the hands after sandblasting or metal will not adhere.

Apply the required amount of metal to the binder or pedestal cap fit to compensate for wear. It has been found that each surface can be built up to approximately 1/16 in. and give good results. If metal has been applied too heavily, it can be removed with a file when the mechanic is fitting it to the frame. This method, where metal spray equipment is available, has been found to be better and cheaper than building up by welding and machining.

Axles (New)

Specifications: AAR-M-104, Class A.
Method of making: Recommend semi-finished heat-treated axles be purchased. However, a road desiring to forge axles from billets should comply with the following heat treating:
Heat treatment: (1) Normalize and (2) temper.

Axles (Reconditioned)

Specifications: AAR-M-104, Class A.
Method of making: Select axles worn below the journal limit and Magnaflux them, making sure they are not defective. Machine the axle to new sizes required, making sure all heat checks have been removed. Any axle machined to new size because of having been overheated should be Magnafluxed after machining.
Heat treatment: Any axle showing severe conditions of overheating should be scrapped, or be re-heat-treated if no defects are found.

Crank Pins (New)

Specifications: AAR-M-104, Class A.
Method of making: Recommend semi-finished heat-treated

crank pins be purchased. However, roads wishing to forge crank pins from billets should comply with the following heat treating:

Heat treatment: (1) Normalize and (2) temper.

Crank Pins (Reconditioned or Made From Scrap Axles)

Specifications: AAR-M-104, Class A.

Method of making: Select crank pins that are worn below limit and Magnaflux them, making sure they are not defective. Machine to new sizes required, making sure all heat checks have been removed, then Magnaflux again.

When using scrap axles the same care should be used as in reconditioning crank pins.

Heat treatment: (Crank Pins Made from Scrap Axles). A slab approximately 1 in. thick should be removed from one end of the axle, polished and etched, and the axle scrapped unless the metal is generally sound. If the micro-structure is satisfactory, the carbon and manganese must be determined, and the axle heat treated to meet specification requirements. The above procedure is mandatory for all main crank pins made from scrap axles.

Flame-Hardening

The section of this report that dealt with flame-hardening consisted of a paper which was presented by F. C. Hasse, general manager, Oxweld Railroad Service Company, before the Southern and Southwestern Railway Club. This paper was published in the *Railway Mechanical Engineer* for December, 1942, and January, 1943. The flame-hardening portion of this committee's report also included sketches of a number of railroad applications of the flame-hardened process.—Editor.

The members of the committee were W. H. Ohnesorge (chairman), shop superintendent, B. & M.; Allan Perry, chief chemist, C. & O.; L. B. Herfurth, forging supervisor, Mo. Pac.; L. E. Grant, engineer of tests, C. M. St. P. & P.; E. J. Hausback, shop superintendent, Wabash; J. S. Miller, supervisor of welding, N. Y. N. H. & H., and H. E. Hoffman, Oxweld R. R. Service Co.

Maintaining Diesel-Electric Locomotives

A discussion of the factors involved in establishing maintenance schedules and an outline of the operations which must be performed periodically

T. T. Blickle,
Chairman

Many Diesel-electric locomotives of various types and designs have been placed in both yard and road service on the railroads in the last 10 years, the use of which has produced numerous methods of scheduling the maintenance required to keep equipment in proper condition, and at the same time maintain high availability.

The manufacturers, in most cases, have prepared maintenance schedules based on their own past experience which are available for use as a guide when setting up maintenance schedules.

It is necessary when setting up any maintenance schedule to have some predetermined value to work by in order to specify the proper intervals when certain items should receive maintenance. Yardsticks which may be used are mileage, time intervals, fuel consumption, hours of service, revolutions performed by the engine, or electrical output of generator; none of which give an absolute indication of the amount of work which has been performed by all parts of the locomotive.

The mileage made by a locomotive in a given period is dependent upon operating and grade conditions and train tonnage, and is not a consistent indication of the amount of work performed by the locomotive power plants. Mileage does, however, have a direct bearing on the service rendered by the wheels and the parts which are connected with them. The use of mileage as a yardstick for handling maintenance involves the keeping of numerous and accurate records and results in considerable clerical work, and is not a true indication in all cases of the amount of work performed by the power plant.

The use of time intervals such as each month, three months, six months, or twelve months as a yardstick for doing certain work on the locomotive is a very simple and convenient method of scheduling the work, due to the fact that government requires that certain work and inspections be made at the same intervals and records maintained accordingly. The grouping of maintenance items at certain time intervals is, of course, based on the assumption that the locomotive will be available and utilized as much as possible and will do sufficient amount of work during that time to warrant the scheduled maintenance, and it is necessary to take advantage of all out-of-service periods in order not to perform unnecessary maintenance.

Using Fuel as a Yardstick

The use of the amount of fuel consumed by an engine as a yardstick for scheduling maintenance requires that methods be provided for measuring the fuel and maintaining a record of the amount consumed by the locomotive. The amount of fuel consumed by a locomotive for power indicates quite accurately the amount of work which has been performed, but it does not indicate what the load factor was while the work was being done which has a very important bearing on the resulting condition of the engine. If the locomotive is equipped with steam generators a considerable amount of the fuel will be used for producing steam and, due to the above reasons, it is not deemed very practical to use fuel consumption as a yardstick for determining maintenance requirements.

The use of actual hours of service as a yardstick to determine when maintenance is needed requires maintaining an accurate record in order to determine what the actual hours of operation were, which is rather difficult to do inasmuch as the locomotive may be operating

in and out of several terminals and have some out-of-service time at each point, and is not a true indication of the amount of work done inasmuch as the load factor and operating conditions causing locomotives to be standing idle are not known.

To use the number of revolutions performed by the engine as a yardstick for maintenance, it would be necessary that the Diesel engines be equipped with a revolution counter. These counters give a true indication of the number of revolutions the engine has made, but do not indicate how many of the revolutions were performed with the engine idling or operating at partial or full load. An engine will require more maintenance per revolution when operating at a high load factor than when operating at low load factor, and due to this it also is not a true indication of the amount of work which has been performed.

The use of generator output as a yardstick for determining maintenance requires that the power plant be equipped with an instrument for recording the amount of energy produced. These instruments would give a true indication of the work performed by the generator but not of the work performed by the engine inasmuch as no current is generated while the engine is idling. The use of generator output as a yardstick for determining the amount of work done by the locomotive would not indicate all work performed by the Diesel engine or what the load factor was.

A survey of maintenance schedules now in effect on some of the railroads at the present time indicate that the common yardstick for scheduling maintenance on switch locomotives are time intervals such as the time of the monthly, quarterly, semi-annual and annual inspections as required by the government regulations, whereas mileage is used for the yardstick on road locomotives with a tendency to group the work items so that the majority of them will fall due at the same time as the government inspections and prevent holding the locomotive out-of-service unnecessarily. The practice of grouping the mileage work items on road locomotives so that they will fall due at the same time as the government inspections appear to be more desirable where large groups of Diesel-electric locomotives are being maintained as it simplifies the record keeping and general handling.

A few railroads have established classified repairs in their maintenance schedules covering the older types of equipment but the tendency at the present time on the more modern equipment is to handle the maintenance currently, and make heavy repairs as inspections indicate the work is necessary. No doubt as more knowledge is accumulated with the operation of Diesel-electric locomotives, it will be desirable and necessary to establish certain intervals for making the heavy repairs.

Owing to the numerous items contained in a maintenance schedule space limitations in this paper will not permit presenting schedules covering each type of locomotive, and only a general schedule covering switch and road locomotives will be given.

Diesel-Electric Switching Locomotives

Daily Inspections

Mechanical:

1—Inspect locomotive for defects.
2—Renew worn brakeshoes and adjust piston travel.
3—Test out sanders and fill sand boxes if needed.
4—Check fuel oil supply and refill, if necessary.
5—Check cooling water supply and refill, if necessary.
6—Check locomotive supplies and replenish, if needed.
7—Check fire extinguishers.
8—Drain moisture from air equipment.
9—Wipe up oil accumulations and eliminate all fire hazards.
10—With engine running, check for leaks, proper pressures, and operation.
11—Check safety appliances.

Electrical:

1—With engine running check to see that batteries are charging properly.
2—Make visual inspection of electrical cabinets.
3—Test out all lights.

Lubrication:

1—Check condition of lubricating oil and supply in main engine and all accessories and replenish, if needed.

Weekly Inspections

Mechanical:

1—Change engine air filters.
2—Change waste packed lubricating oil filters, if necessary.

Electrical:

1—Check battery water and gravity.

Lubrication:

1—Check oil in traction motor support bearings.
2—Check oil in journal box bearings.

Monthly Inspections

Mechanical:

1—Check Diesel engine speeds.
2—Check setting of fuel injectors.
3—Make visual inspections of pistons and crankcase.
4—Check all vee belts for condition and tension.
5—Clean fuel filtering equipment.
6—Check condition of cooling system and flush, if necessary.
7—Clean all breathers.
8—Clean air compressor filters.
9—Clean locomotive interior and exterior.
10—Check operation of emergency fuel cut-off valve.
11—Make all inspections as required by law.
12—Check cylinder head mechanism with engine idling.
13—Check all bolts.
14—Inspect all engine auxiliaries.

Electrical:

1—Check auxiliary generator voltage.
2—Inspect and clean all motors and generators and renew brushes where needed.
3—Inspect and clean all electrical equipment and auxiliary equipment.
4—Check high and low voltage systems for grounds.

Lubrication:

1—Lubricate traction motor gears.
2—Grease throttle linkage, governor linkage and shutter linkage.
3—Grease all fans.
4—Grease generators and traction motors.

Quarterly Inspections

Mechanical:

1—Make all inspections as required by law.
2—Check calibration of temperature and pressure gauges on the engine.

Lubrication:

1—Change lubricating oil in engine, clean all strainers and wash down lubricating oil system.

Semi-Annual Inspections

Mechanical:

1—Make all inspections as required by law.

Lubrication:

1—Change air compressor oil.
2—Grease flexible couplings.

Annual Inspections

Mechanical:

1—Make all inspections as required by law.
2—Inspect engine bearings.
3—Recondition air compressor valves.
4—Recondition locomotive paint where needed.
5—Recondition pistons and cylinder heads where inspection shows necessary by test.

Electrical:

1—Make inspections as required by law.
2—Overhaul fuel pump motor.
3—Clean and paint exposed wiring and cables.
4—Check settings of relays.

Two-Year Inspections

Mechanical:

1—Remove and recondition pistons, heads and liners.

Four-Year Inspections

Mechanical:

1—Overhaul air compressor.

Electrical:

1—Overhaul traction motors and auxiliary generators.

Road Locomotives

After Each Trip or Day's Work

Mechanical:

1—Check fuel oil supply and refuel, if necessary.
2—Check engine cooling water supply and refill, if necessary.
3—Check boiler water supply and refill, if necessary.
4—Check brakeshoes and renew those worn down to minimum thickness.
5—Inspect locomotive for defects.
6—Clean locomotive and eliminate all fire hazards.
7—Inspect all fire extinguishers and maintain in operating condition.
8—Test out sanders and fill sand boxes if needed.
9—Test out air brake equipment according to outstanding instructions.
10—Inspect cylinder assemblies applied previous trip and retighten if necessary.
11—Adjust brake cylinder piston travel.
12—Check locomotive supplies and replenish if necessary.
13—Drain moisture from air equipment.

Electrical:

1—Test out all lights.
2—Make visual inspection of all electrical cabinets.
3—Test out locomotive for proper operation and control.

Lubrication:

1—Check lubricating oil supply in all equipment and replenish if necessary.
2—Fill lubricating oil supply cans.
3—Check condition of lubricating oil.

2,500-Mile Inspection

Mechanical:

1—Inspect cylinder head mechanism with engine idling.
2—Inspect pistons, liners and interior of crankcase.
3—Clean engine air filters.

Semi-Monthly (5,000 Miles Freight Service; 10,000 Miles Passenger Service)

Mechanical:

1—Inspect condition of cooling system.
2—Inspect V belts for condition and tension.
3—Removve and repack waste type lubricating oil filters. Filters should be changed whenever oil becomes dirty.

Electrical:

1—Inspect traction motors, main and auxiliary generators and renew worn brushes.
2—Check battery water and gravity.

Lubrication:

1—Check oil level of traction motor suspension bearings.
2—Lubricate traction motor gears.
3—Check oil level in journal boxes.

Monthly Inspection (Approximately Each 10,000 Miles Freight Service—20,000 Miles of Passenger Service)

Mechanical:

1—Load test Diesel engines at full load for at least 30 min. and do the following: (a) check Diesel engine speeds; (b) inspect for leaks; (c) check governor operation; (d) check all pressures and temperatures and maintain a record and (e) remove and clean oil coolers if temperature is excessive.
2—Blow out radiators.
3—Clean car body filters.
4—Clean air compressor air filters.
5—Clean all breathers.
6—Drain condensation from fuel filters and tanks.
7—Clean fuel filters.
8—Check operation of emergency fuel cut-off valve.
9—Make all inspections required by law.

Electrical:

1—Clean and inspect all motors and generators.
2—Clean and inspect all electrical equipment.
3—Check locomotive for grounds.
4—Check operation of all alarm devices.
5—Check auxiliary generator voltage.

Lubrication:

1—Grease fan and blower bearings.
2—Grease all control linkage.
3—Grease all traction motor bearings.

Each Two Months (Approximately 20,000 Miles of Freight Service—40,000 Miles of Passenger Service)

Lubrication:

1—Change engine lubricating oil.

At Time of Quarterly Inspection (Approximately Each 30,000 Miles of Freight Service—60,000 Miles of Passenger Service

Mechanical:

1—Make all inspections required by law.
2—Check fuel injection timing.
3—Check and adjust valve clearance.

Electrical:

1—Inspect and clean voltage regulators.
2—Inspect and clean dynamic brake grids.
3—Inspect and clean control stand.

Lubrication:

1—Grease all flexible couplings.
2—Change air compressor oil.
3—Grease main generator.

At Time of Semi-Annual Inspection (Approximately 60,000 Miles of Freight Service—120,000 Miles of Passenger Service)

1—Make all inspections required by law.
2—Remove, clean and calibrate speed recorders.
3—Remove, clean speed recorder drive cable.
4—Check crankshaft and thrust.
5—Drain and flush engine governor.

At Time of Annual Inspection (Approximately 120,000 Miles of Freight Service—240,000 Miles of Passenger Service)

Mechanical:

1—Make all inspections required by law.
2—Remove and recondition air compressor valves.
3—Remove and inspect engine main bearings.
4—Check all thermometers.
5—Check settings of hot engine and low oil pressure alarm devices.

Electrical:

1—Clean and paint all exposed wiring and cables.
2—Overhaul fuel pump motors.
3—Test all relay settings.
4—Check tightness of all terminals and wiring connections.

Lubrication:

1—Oil all electro-pneumatic control cylinders.
2—Lubricate reverser.

Each 200,000 Miles

1—Overhaul traction motors.

Each Two Years (At Time of Annual Inspection)

1—Dismantle, clean and inspect engine governor.
2—Recondition air compressor.
3—Recondition all contactors, and reversers and control equipment.

Each Three Years (At Time of Annual Inspection)

1—Inspect engine drive gears and chains.
2—Inspect engine blowers and turbo-chargers.
3—Recondition auxiliary generators.

As mentioned previously, the above schedules do not apply to any particular type of locomotive and is intended only as a general guide as each type of locomotive is of different design and requires the maintenance of certain items which are used on that type of power only.

The frequency of lubricating oil change depends en-

tirely on the condition of the oil which can only be determined properly by making a chemical analysis.

The removal of pistons for reconditioning based on mileage or time intervals, results in unnecessary piston pulling as many times the cylinders are still in good condition, and considerable piston pulling can be eliminated by careful inspections being made by properly trained men. There are, however, occasions when it is desired to operate engines for set periods of time which requires that the pistons be in condition to operate for that period and to do this it is necessary to condition the engine to operate for that period. To do this it is necessary to remove the pistons periodically. These are operating conditions which have a direct bearing on the method of maintaining the locomotive.

The scheduling of Diesel locomotive maintenance in the future no doubt will change as more experience is gained and new designs are developed which will bring about improved performance by the locomotive.

The members of the committee are T. T. Blickle (chairman), supervisor of Diesel engines, A. T. & S. F.; E. J. Feasey, chief inspector of Diesel equipment, Can. Nat.; R. I. Fort, mechanical inspector, I. C.; J. E. Kilker, supervisor of Diesel equipment, Mo. Pac.; R. W. Murray, general supervisor of Diesels, Seaboard; P. M. Rooker, general mechanical instructor, A. C. L.; R. G. Tausch, Diesel supervisor, Gr. Nor.; H. E. Taylor, Diesel superintendent, Southern; J. H. Whipple, Diesel, supervisor, D. & R. G. W., and G. P. Wiles, general supervisor of Diesel electrical equipment, B. & O.

George E. Bennett

Use of Welded Parts Can Be Extended

Observation of welding practices and equipment in the builders' plants leads to the conclusion that the railroads can profit by the new methods

The subject selected this year is that of fabrication best illustrated by the builders of Diesel locomotives. What a revelation it is to walk through the well equipped shops of the builders of Diesel power. It is time well spent to see the developments made in technique, positioners, testing laboratories and equipment especially designed to further progress in welding.

There is no reason to believe that many of these methods are not applicable to the building and maintenance of steam locomotives. It is true that we who have been associated with steam locomotives are slow to see the possibilities of welded fabrication.

The old axiom "necessity is the mother of invention" has been brought home to all of us many times in the past four years. The number of accidents has increased at least proportionately to the increased mileage, and has presented a number of problems in locomotive parts replacements. Little-used deck plates, pilot beams, engine and trailer truck frames, etc., have had to be replaced where the pattern cost and delay in the making of a pattern, along with delay in the casting of parts, just did not fit into the picture of increased demand for power. What did we do? We turned to the cutting torch, the arc welder, the normalizing furnace, and in some instances, to the X-ray and Magnaflux methods of testing and found that not only could we fabricate the part quicker, but also better in quality of construction, physical and chemical properties, and at lower cost.

Equipment Need Not Be Elaborate

Equipment for the average shop need not be elaborate. Proper welding machines, well maintained, and well trained welders are the prime requisites. Needless to say the correct electrode is also of importance. Inasmuch as the average shop cannot be classed with the production shops of industry, we find it impossible to justify the cost of elaborate positioners. However, with a little ingenuity, positioners can be built at low cost in the shop to handle such work as we want to.

One of our larger railroads has successfully fabricated driving boxes at lower cost than the conventional cast steel, and they have proved to be of greater strength. The method is as follows: A three-piece design was followed; a center section and two side sections were flame cut from a billet. The center section was beveled inside and out to secure 100 per cent penetration and welded, using a reverse polarity shielded arc rod of 5/16 in. and 1/4 in. diameter. The forging was then stress relieved at 1,000 deg. F. after welding.

Another railroad reports driving box grease cellars fabricated as follows: (The dimensions given are to help describe the procedure and can be altered to suit). The material used is two pieces 8-in. by 6-in. by 7/16-in. angle iron, one piece for the end is mild steel, 3/8 in. thick, size to suit, and one piece 3/4-in. by 1-in. by 8-in. mild steel. The angle iron is cut to suit for length, one edge planed and veed for width. The end piece is veed on the bottom and the edges and tack welded flush with one end. A piece of 3/4-in. round open-hearth steel is then tack welded from the top in a flat position. The end plate is then welded in. The 3/4-in. by 1-in. by 8-in. piece is welded on bottom, 5/8 in. from the inside end; this piece is not veed. A single pass fillet weld across each end and on the side next to the inside end of the cellar is used. A pad 1 in. by 3 in. is built up on each corner, thickness to suit, for fit in the driving box. Clearance for the journal is then flame cut in the end piece and the edges planed to suit. The cellars are not stress relieved. After removing the 3/4-in. rod, a blow in the line of the weld with a medium weight hammer removes the slight warpage.

Air Pump Brackets

The same road also fabricates double air pump brackets for application to the front end of locomotives as follows: This bracket is made of 1-in. scrap boiler plate; the sides are 32 in. high, 28¼ in. wide and 49 in. in length. The procedure adopted in fabricating the bracket is as follows: Bend two pieces 1 in. by 28¼ in. by 56¼ in. each, to form one-half of the bottom and one end; two pieces 1 in. by 32 in. by 45 in. were flame cut to form two ribs to be welded inside the bracket 4⅜ in. from the edge, front and back. The back ribs were cut to the contour of the smokebox, making the rib height 26 in. in the center. The front rib was cut to 12 in. height in the center on 8 in. radius at the lowest point. Two 12-in. square openings were cut in the back rib spaced 5 in. from the bottom and sides, respectively. Two triangular openings are cut in the front rib, spaced 5 in. from the bottom, sides, and angle at the top edge of the rib. After bending the two pieces to make the bottom and ends, they are tacked together and the ribs tacked in position. The ribs are not veed, and are welded by alternating the welds to compensate for stresses, using stringer beads to make ⅝-in. fillets. Four pieces 1-in. by 3½-in. by 45-in. open-hearth steel, with ¾-in. lug turned at right angle on one end of each, to form bottom lugs for pumps, were then welded on each, outside corner flush with the edges. A ⅝ in. fillet across each end and one stringer bead along each side secured these pieces to the bracket. The edges of the bracket were heated and squared up after welding. No other stress relieving was done on it. Reverse polarity rods, $^{3}/_{16}$ in., were used.

The above described parts are just a few of the many we find possible and from the methods described, it is easy to see how many parts can be fabricated, such as light-weight crosshead shoes, main cylinders, guide yokes, valve gear frames, step plates, stiffener ribs, and gussets, bolsters, draft gear assemblies, front and back deck plates, frame braces, smoke stacks, bases and lift pipes, feedwater pump brackets, indented feedwater tanks, tender underframes and cistern, front and back cylinder and valve chamber heads, engine truck and trailer cellars, pilot beams, various pipe fittings, throttle lever brackets, ash pans, boilers, and a thousand and one other parts.

The general practice in most parts is to use low-alloy, high-tensile steel, thus giving a part of greater strength and lighter weight. We all recognize the fact that when down-hand welding can be used, it is much superior in quality and the cost is lower. This can be attained by the use of proper positioners.

It is impractical to give figures in dollars saved through fabrication as practically all parts differ on various railroads. But those interested will find methods and techniques that will open their eyes to possible economies.

It is also well to remember that stress relief is of great importance and most of all the fabricated parts should be stress relieved or normalized. This can be accomplished by the use of a furnace of regular or car-bottom style or adequate size to take the entire part.

* * *

There are several makes of automatic flame cutting machines on the market, which can be used to a great advantage when more than one of a part is to be fabricated. This again will lower costs of fabrication.

Another fact brought out by all members of the committee and well worth considering is that welding is an art that involves manual skill and constant practice for the best results. The railroads have many men doing welding intermittently, who would show remarkable improvement in skill if they were regularly assigned.

The railroads would find it practical to appoint a man to push welded design. He must have the initiative necessary for leadership against the forces of tradition, as there will always be those with old ideas. He must always keep a deep-seated faith in the soundness of arc welding and the methods of fabricating to cut costs and improve quality. A man who has the practical knowledge and experience in welded design and production is going to do a lot in the post-war period when the railroads will be striving to keep ahead of other means of transportation.

The members of the committee are George E. Bennett (chairman), shop superintendent, C. & E. I.; Harry M. Moreland, welding supervisor, C. & O.; Ralph G. Fagerburg, assistant boiler foreman, Alton; M. A. Thompson, foreman welder, B. & M.; Bernard Wallard, welding instructor, C. & N. W.; and Emerson Murray, welding instructor, C. & E. I.

F. K. Mitchell,
Chairman

The Experience of American Railroads With Employee Suggestion Systems

A report of the Committee on Employee Relations outlining the advantages, disadvantages and results obtained from such systems

This Committee has undertaken a study of the so-called "Employee Suggestion Systems" in operation on railroads in order to give the membership the benefit of such data as were found available and our observations on pertinent related problems.

In the process of collecting this information questionnaires were forwarded to those railroads which, according to our best information, had such systems in operation. These questionnaires requested information on: (1) The type of system; (2) how sponsored; (3) brief description of its working; (4) title of officer supervising the system; (5) how suggestions are screened; (6) how accepted suggestions are tried out; (7) basis of awards; (8) maximum and minimum awards paid; (9) total number of employees eligible to submit suggestions; (10) average total suggestions received per month; (11) average total suggestions accepted per month; (12) estimated annual administration expense and savings; (13) how any patent expense is defrayed; (14) ownership and other patent arrangements; (15) difficulties experienced, and (16) benefits derived.

The detailed information received through these inquiries is of a confidential nature and in our discussion, therefore, no mention will be made of the individual railroad or company whose data or other information is quoted.

The total number of employees eligible to submit suggestions, as reported by those companies from whom replies were received, was 382,033. The same companies reported a monthly average of 10,813 suggestions received. The total monthly average number of acceptable suggestions received was 2,685. The average length of time during which these systems had been in effect was 8 years 4 months. It will be observed, therefore, that the experience analyzed by the committee was sufficiently extensive to afford some logical broad conclusions to be drawn. This, we believe, is true with the exception of two pertinent questions, namely, the cost of administrating such a system and the savings which might be expected. No company to which the questionnaires were addressed offered any information thereon.

Without exception each of the companies whose systems were studied, are using what might be termed an anonymous system. This term is derived from the fact that a bonafide attempt is made to prevent any partiality on the part of the judges responsible for accepting or rejecting suggestions by providing that all suggestions submitted carry no reference to the name of the employee making the submission. This is accomplished either by having all ideas submitted on standard numbered forms, the employee retaining a stub having the same number, or by the submission carrying only the employee's check or payroll number. Thus when the merits of the suggestion are under discussion, the committee has no knowledge of the identity of the originator.

Machinery of Administration

The general machinery set up to administer these systems is as follows:

At the head of the so-called system is a supervisor, or manager, who has general supervision over its entire functioning. Under him is a general committee. This committee is usually composed of department heads, or their selected representatives, and an equal number of representatives from the labor groups. This committee is the body which has the final decision as to whether suggestions are acceptable or not. It has regular meeting times and is supposed to be furnished with copies of the current suggestions sufficiently in advance of the next meeting to give it an opportunity to check for duplications and to study the merits of each. It likewise fixes the amount which is to be paid for each acceptance.

In the case of larger companies, local joint management-labor committees are set up. The function of these local committees is to screen those suggestions submitted by employees in certain local areas or shops. This committee ordinarily does not have the final decision as to acceptance, but does have powers to reject any obviously impractical or unsound suggestions. Neither does this local committee have a voice in deciding the amount to be paid for a suggestion. Its function is to pass on to the general committee for final action such suggestions as are, according to its judgment, worthy of further consideration.

Further than the above, the system provides media for keeping employees interested and some simple method of getting suggestions before the appropriate local or general committee, such as providing necessary forms, use of company mails and/or suggestion boxes located at convenient places from which regular collections are made.

It was found in our study that the practice exists universally of dividing suggestions into two categories—those from which tangible savings can be expected, and those from which no tangible saving can be expected. Minimum awards for accepted suggestions which fall in either category have usually been established as $5.00. Maximum awards are made on a different basis for suggestions in both categories. It is almost the universal practice that the award for an accepted suggestion from which tangible savings can be expected is on the basis of 10 per cent of the estimated annual savings. In making awards for suggestions from which no tangible saving can be expected, the award has been entirely dependent on the judgment of the general committee as to its value. Maximum rewards ranging up to $2,605 for a single acceptable suggestion were reported.

All suggestions received are considered the property of the company, after awards have been made to their originators. Such suggestions as are patentable, and if in the judgment of the company it is desirable to do so, are patented. In these cases the company defrays reasonable expense of search and patent proceedings, obtaining the patent in the name of the suggestor in exchange for a license agreement covering its use by the company. This arrangement seems to have worked out satisfactorily to all concerned and no controversies were reported to have arisen between the parties.

On the other hand, it is apparent that other features in connection with suggestion systems have been troublesome. One road reported having dropped the idea because of spotty employee response and waning interest and enthusiasm. Other reported difficulties were:

A tendency on the part of some supervisors to feel that a suggestion from anyone relating to his department is a reflection on his ability and methods.

A tendency on the part of some labor organizations to discourage their members from submitting suggestions which might result in reducing man-hour requirements.

A failure to allow the general committee sufficient time and opportunity to determine the merits of a suggestion before having to establish a reward for it.

The inability of the general committee to make an accurate forecast of the annual savings and being faced with the necessity of making an on the spot decision as to the amount of the reward.

Advantages of the Systems

Despite the difficulties which have arisen, the majority of reporting roads and companies consider that the benefits derived from the suggestion system far more than offset them. Some of the advantages stressed were:

Improves employee relations by establishing a feeling that the employee is a part of management.

Increases the employees' interest in their work.

Encourages initiative, observation, analysis and constructive thinking by providing a channel through which ideas pertaining to the employees' work can be submitted without fear of criticism.

Provides financial benefit to both employer and employee.

On the strength of the foregoing, the Committee feels that the adoption of an employee suggestion system might be anticipated to produce results, both positive and negative, in the locomotive department somewhat along the following lines:

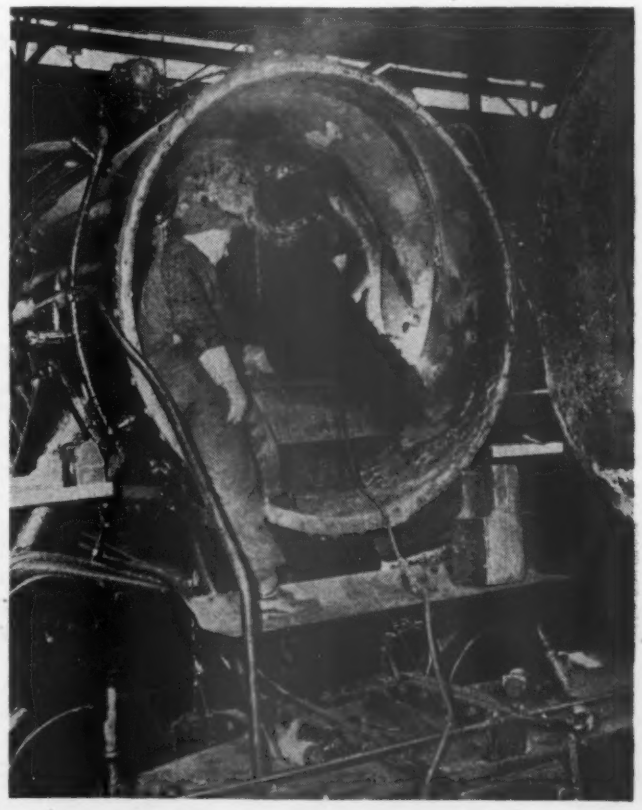
You might expect to receive suggestions from about three per cent of your employees each month. This ratio would be higher to start with and taper off to about that figure.

Of the suggestions received you might expect about one-quarter of them to be acceptable. This ratio would probably start lower and increase to about that figure as the employees gradually learn the type of suggestion which is worthwhile.

You might expect that at the outset a large number of suggestions would not be suggestions at all but rather grievances expressed through the media of the suggestion system. Further, however, you might also expect a recession of this type of so-called suggestion, but not a cessation of them, as time went on. We believe that if you adopted a sensible, fair method of disposing of this type of problem during the screening process, very few grievances would eventually be advanced through these channels.

You might expect opposition from some supervisors and some labor representatives. Opposition from the first group might be due to jealousy and a feeling that any such suggestions are a reflection on the supervisors in the departments from which the suggestions come.

* * *



Diplomatic handling of this matter would be necessary but effective in eliminating it. You might expect that opposition from the second group would arise due to a fear that, through the adoption of certain suggestions, management might take advantage of them to reduce employment. This poses a real problem, for there is no contradicting the fact that such a thing might occur. This, however, may be offset by the fact that greater efficiency in railroad maintenance and operation will strengthen the railroad in its spirited competition with other types of common carriers—some of which are at least partially subsidized—and thus insure greater stability of employment for railroad employees.

Objections May Be Expected

You might expect objection on the part of both supervisors and men to the method of establishing awards for suggestions capable of producing tangible savings. Establishing such rewards on the basis of estimated annual saving is, we believe, not fair to either the company or the employee. We gather from the data reported that this basis was adopted in order to avoid the necessity of setting up the necessary machinery for determining the actual saving produced. This conclusion is based on the repeated statement that no estimate of the total annual savings produced by the employee suggestions system could be given because no procedure had been set up to produce that information. We hold that no committee, regardless of the experience and background of its members, can forecast the annual saving which any suggestion may produce, this being particularly true where a decision must be reached within a few days or weeks after the suggestion comes to their attention and before it has been given actual trial. We further hold that in this consideration, as in all others, if a job is worth doing at all, it is worth doing right, and that therefore the actual annual saving should be developed by trial before the final award is made even though this means off-setting the total saving by the clerical and supervisory expense necessary to establish the actual saving over the period of a year. By so doing, a guarantee to management that it is not paying for a saving which might actually be far less, or even a loss, and a guarantee to the employee that his award was commensurable with its actual merit would be established. We would, therefore, suggest that the objection under discussion could best be met by payment of a lesser initial award, augmented at the end of a year by a fixed percentage of the actual saving.

Finally, the committee feels that if the objections it has pointed out are overcome, either as recommended by us or in some other satisfactory manner, and a system in all other respects the same is kept honest, open and above criticism, the motive power shop and terminal operations will be benefited by the adoption thereof, which in turn means that the road as a whole will reap the benefits which have been mentioned.

The members of the committee are F. K. Mitchell (chairman), assistant general superintendent motive power and rolling stock, N. Y. C.; C. F. Brooks, mechanical engineer, Erie; K. Berg, superintendent motive power, P. & L. E.; W. V. Hinerman, assistant to superintendent motive power, C. & O.; H. J. Schulthess, chief personnel, D. & R. G. W.; A. H. Williams (retired) and Roy V. Wright, editor, *Railway Mechanical Engineer*.

A. Malimgren,
Chairman

Maintenance of Air Brake Equipment

A detailed description of the operations involved and the special tools needed for making repairs to brake pipe vent valves

Before assembling the KM vent valve, all parts should be carefully inspected. Referring to Fig. 1, check the 1/16-in. stabilizing port in the piston rim (note the drill in the piston rim) and the port in the unseating pin (note the No. 30 drill in the side of the unseating pin). With the older style piston and bushing assembly, the charging choke is screwed into the piston face. This choke should be cleaned and checked with a No. 77 drill. In the latest modification, this choke is blanked and the charging port is drilled through the bushing wall (see Fig. 2 showing a No. 77 drill projecting through the outer side of the bushing wall).

Check the alignment of the unseating pins with Tool A (Fig. 1) which is bored in three steps to conform to the three diameters and length of steps on the unseating pins. With the unseating pins housed in Tool A, leaking or loose pins may be swedged or tinned without any chance of misalignment.

Tool B is also bored in three steps to conform to the

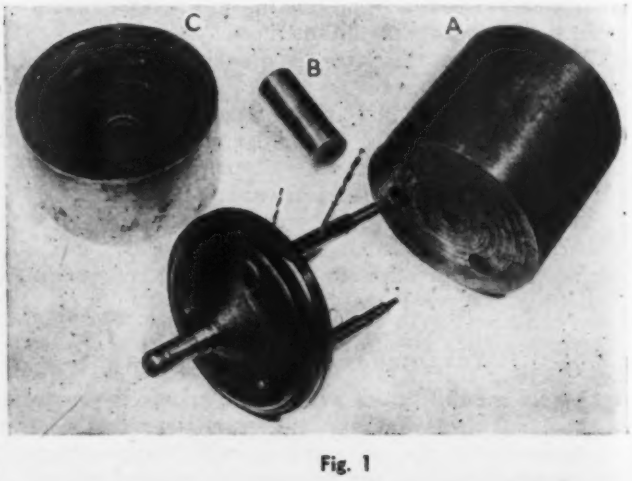


Fig. 1

diameters on the unseating pins. It is used as a gauge to check wear, such as fins, that may develop from lifting the pilot and main vent valve and to determine that the pins are not bent.

Tool C is used to grind the face of the piston gasket to insure the removal of any irregularities or high spots and obtain a uniformly thick gasket so that the piston will readily seal on its bushing seat with a minimum of pressure on the piston. Slightly worn gaskets may be reclaimed with Tool C. The shoulder or collar of Tool C which provides the cutting base is covered with an abrasive cloth or paper which is glued to this base and against this cloth the piston gasket is rubbed or

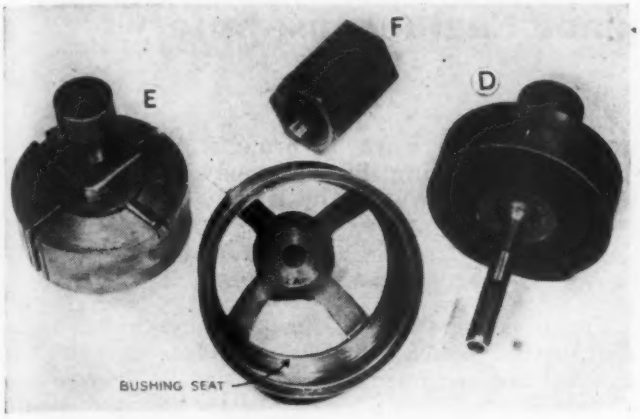


Fig. 2

ground. The pilot hole in the center of Tool C is concentric with the face of the piston gasket which is guided by the piston stem.

Clean and check the charging port on the inner wall of the bushing with a No. 77 drill. This is shown in Fig. 2. Usually it is found that a No. 77 drill is loose and the next larger size, No. 76, is a tight fit in this port.

Check the bushing seat for slight nicks which are polished or rubbed out with Tool D. This is the seat against which the piston gasket seals and, like the gasket, it must be in correct alignment to permit easy sealing of the gasket (not requiring heavy piston pressure to indent the gasket to make a seal or separation of the brake pipe and quick-action chamber).

Tool E is a grinder to smooth away scratches or cuts or any unevenness due to wear on the inner face of the piston bushing. Uniform bearing of the piston packing ring on the walls of this cylinder is just as important as it is in any other form of triple or control valve.

Tool F is a holder screwed on to the guide portion of the bushing to hold the bushing in a vise for the above operations.

Tool G (Fig. 3) is a holder for the main vent valve. With the main vent valve securely anchored to Tool G, Wrench H is used to remove the main vent valve seat whenever it becomes necessary to replace the gasket seal. At the same time, the application of the main vent valve to Tool G automatically checks the condition of the holes that fit on the unseating pins. A similar tool is used to check and straighten the legs on the pilot valve, but is seldom used as no distortion is found in service wear.

The tools described, with the exception of Tool E, were shop made.

The latest test code requires a check of the ability of the piston seal to seat easily against the bushing seat. This test is made by restricting the charging rate of the brake pipe, after a 15-lb. reduction has been made. A ⅜-in. by-pass pipe with a No. 10 drill choke provides the means for retarding the rate of build up in the brake pipe volume pressure and on the face of the piston. If the gasket seal on the piston does not seal against the bushing seat with this test, the quick-action chamber of the vent valve will charge rapidly with the brake pipe rise. If the piston gasket does seal properly it will require eight or more seconds to charge from 55 lb. to 67 lb. This test is a real check on the condition of the packing ring fit, the piston gasket and the bushing seat. In our shops it is common to find 11 seconds are required to charge from 55 lb. to 67 lb.

The pilot valve and main vent valve will fit freely on the unseating pins if the alignment is as it should be and parts pass the checking tools.

No. 4 Brake Pipe Vent Valves

Before assembling the No. 4 vent valve all parts should be carefully inspected. If the vent valve reservoir is not removed from the locomotive, the ⅜-in. and ½-in. drain plugs should be removed and the interior chamber thoroughly blown out with compressed air. If the inner walls of the chamber are rusted, the reservoir should be removed and cleaned in a lye vat, thoroughly washed and scaled and then given a bath in hot paraffin. If this treatment is given when locomotives are stripped in the shop, it is reasonable to expect rusting will not occur between shoppings.

Check and clean the 1/16-in. charging port in the cylinder bushing, and the No. 72 drill choke in the bushing underneath the ½-in. ball check valve. Check the condition of the piston bushing, packing ring and piston groove, noting that the bushing is true and the packing ring is correct size for the bushing. Friction must be kept to a minimum and the packing ring fit in the ring groove and the end cylinder walls should be as correct as it can be made. Excessive friction is the usual cause for undesired emergency. Examine the slide valve and its seat for cuts, etc., that may produce friction and leak-

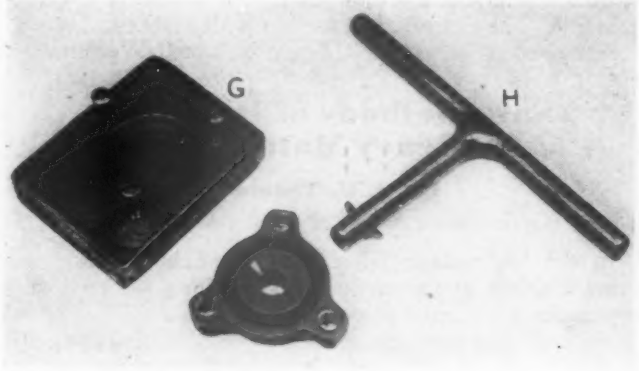


Fig. 3

age, and piston stem and slide valve bushing for shoulders or worn places that may cause undue resistance to piston movement.

The graduating stem in the piston and its stop in the reservoir must be checked for wear. It is important that the stem in the piston contacts the stop in the reservoir when the service port in the slide valve is wide open to the exhaust port. Over travel may restrict the service port and cause undesired emergency. When the reservoir is removed for cleaning the gasket face the reservoir should be examined for rust pits and if necessary machined to a true seat, taking care to maintain the original dimension between the gasket face and the piston stop. If the piston stop is eaten away, and requires refacing,

it may be necessary to reface the gasket face to maintain the original dimension between the piston stop and the gasket face.

The strainer in the No. 4-B vent valve plays an important part in keeping water and dirt from the piston cylinder chamber. Water and dirt cause high friction and lead to undesired emergency; hence, the strainer should be maintained in the highest degree of efficiency at all times. The cylinder bushing should be kept true and polished by using a bushing grinder as shown in Fig. 2. With a true bore in the cylinder, a stuck packing ring may continue in service until the cleaning date without causing any trouble or erratic action. On the other hand packing ring leakage may prove very detrimental, particularly on roads that permit the use of release position when releasing train brakes.

The report was signed by A. Malmgren (chairman), assistant superintendent, St. L.-S. F.; A. J. Pichetto, general air brake engineer, I. C., and W. E. Vergan, supervisor air brakes, M-K-T.

Promoting Shop and Enginehouse Safety

Safety in car and locomotive work is brought about by hiring good men, training them properly and educating the foremen to watch the results

E. L. Henry, Chairman

This year's report of the Committee on Safety consisted of a group of individual papers on various phases of the subject of safety in car and locomotive shops and enginehouses. Two of these are abstracted below. Other papers were submitted by G. A. Robinson, assistant general safety agent, Chesapeake & Ohio; J. L. Chapman, machine and erecting foreman, Illinois Central; O. B. Cavanaugh, master mechanic, Northwestern Pacific, and Norman Peterson, assistant shop superintendent, Boston & Maine. The chairman of the committee is E. L. Henry, superintendent of safety, Chicago & North Western.

Safe Methods of Handling Heavy Material

By H. H. Thomas,
Superintendent Shops, Chicago & North Western

In the last quarter of a century we have witnessed many changes in the methods of handling material and appliances for motive power.

Material and equipment are subjected to handling by various kinds of equipment—overhead traveling cranes, improved drop tables, transfer tables, power unit cranes, power lift trucks, power fork trucks, tractors, electric or air-powered hoists, air powered jacks, and numerous other lesser devices. Slings and attachments used in conjunction with the above equipment should be designed to expedite work safely.

All material from small items up to the largest castings, boilers or bundles of jacket steel weighing from 100 lb. to 50 tons, must be handled with the proper safety factor in mind.

More pliable slings made of braided cable which are easier to handle are in extensive use now. Cables must be inspected for wear and damage regularly and replaced when they show signs of unsafe condition. Chains which are still used for certain kinds of lifts require periodic inspection and annealing.

Crane operators must be in good physical condition, alert, have a thorough knowledge of shop sequence, understand and recognize only hand signals, disregarding all signals given orally because of the extreme danger to life and property, caused by misinterpretation of signals. Carrying material over workmen is strictly prohibited, and a warning gong is provided for the use of the crane operator.

Handling Material for Steam Locomotives

Driving tires are cumbersome, weigh up to 1,700 lb. each on large passenger power, and constitute one of the greatest safety hazards in material handling. When carried horizontally in sets of six or eight they are lifted by means of three-leg bridle slings with hooks attached. For applying a tire to a wheel center a forged lifting adapter which locks over the tire flange is used. After removing hot tires from wheel centers, special care must be used, if they are to be stacked vertically, resting on the flanges, to see that there is no possibility of their skidding down. Hot tires have a greater tendency to skid than cold ones.

Running gear, rods, motion work, and other greasy materials removed from the locomotive in the process of stripping, are placed on lift truck skids having special perforated basket-like bodies, and carried to the lye vats for degreasing after which the load is delivered to the proper departments before the skid is unloaded.

Flues and superheater units are loaded on a rack as they are removed from the boiler. The rack is built especially for the purpose, having arms integral with its uprights to which the lifting cables are attached, and it remains with its load until the flues are re-applied to the boiler.

After unwheeling a locomotive, the wheels are removed from the track by placing a cross-bar with a ring in it, through the spoken section; they are lifted with an overhead crane and then placed on a dolly for transporting to the wheel shop. This practice superseded the dangerous practice of rolling them by hand.

Driving springs weighing 500 or 600 lb. are quickly and easily placed in their proper position on the locomotive by using a length of seamless tubing having a movable attachment for connecting to a crane hook.

Air reservoirs are applied underneath runboards by using a specially constructed two-fingered hook that will attach to a crane hook. The construction of this hook provides for securing the reservoir against slipping out endwise or rolling off before releasing, which is not done until after the reservoir bracket straps are securely bolted around it. Also, a spring arrangement at the crane hook connection allows for a moderate miscalculation in judgment of signals to prevent damage to runboard that would otherwise result from lifting the reservoir too high when it is under the runboard.

Lift truck skids have been designed for different classes of material handling. Some are made especially to handle certain objects that do not lend themselves readily to conventional form skids.

Heavy material, such as locomotive beds, cylinders, boilers, etc., are transported on flat cars into the shops where they are picked up by overhead cranes.

Material for Diesel Locomotives

The engine and generator unit is applied by means of an overhead crane, using a cross-bar with short cable slings attached at the ends. The cross bar has a fixture with a movable king pin in the center to adjust for center of gravity, which keeps the unit level and facilitates aligning.

Generators can be handled singly by overhead crane using four leg slings and rings with clevises attached which are coupled to our eye-bolts screwed into the generator housing.

Truck removal for wheel and traction motor work is done by means of power jacks located at sides of car and under the jacking lugs. Safety blocking is used at the ends to protect workmen against a possible jack failure. After this is done, the drop table under the truck is lowered and moved clear.

Traction motors are removed from trucks by means of an overhead crane. The crane is also used to manipulate the motors into position for easy removal of bearing caps, wheel removal, and inspection. Lift trucks are used to transport motor and wheel assemblies to the proper department. Overhead cranes with rope slings handle parts through the service door.

On switching power on which the doors open on the side, cylinder heads are removed by crane and a lever similar to the method described for steam locomotive driving springs.

Safety of operation in maintenance and repairs, whether it be on assembly or getting material to the point wanted, is an important factor today. Accident prevention has priority over all operations, and safety recommendations are encouraged from the rank and file. Material on the job when needed is what every supervisor desires. To do this, all safety precautions must be adhered to and prevent what we all detest—Accidents.

The Foreman's Responsibility in Accident Prevention

By R. McLean,
Master mechanic, Denver & Rio Grande Western

In any discussion or planning of methods to improve the safety record in shops where a large number of men and women are employed the responsibility of the departmental foremen and the part they are to take in preventing personal injuries must be given first consideration. We expect the foreman to plan his work and distribute it among the employees in his department so the maximum results can be obtained at minimum cost. The mechanics in his department look to him for leadership in outlining their duties, inspection and criticism of their work. They respect him if he is tolerant but insistent on proper workmanship, but if he is careless in this respect his attitude soon affects the morale of everyone under his supervision.

If we are to get efficient supervision in matters pertaining to quantity and quality of work we must also have efficient supervision to see that the work is carried on safely. To get maximum results demands the coordination of both these efforts. Too many foremen have an eagerness only to meet their schedule—and often the schedule is interrupted and delayed due to their lack of eagerness to include safe methods in their supervision and this attitude also has an adverse effect on the morale of employees under his supervision.

Therefore, the duties of a foreman embrace the responsibility of planning safe methods of performing the

* * *

work in his department and personally seeing to it that the safe method is used. To bring this about the foreman, unless he has a natural talent for safety work and willingness to practice it, must be imbued with the ideals of safety by his superior officer. The foreman's procedure in the promotion of safety should include talking to each new employee individually about the work they are to perform, reveal the known hazards and outline the method that from experience has been found to be the safest method. He should make it a point to know that each new employee in his department is furnished with a book of safety rules and instruct him or her to read it and study it. I believe the impression thus made is invaluable in his future contact with the employee. After the employee has been started along the right line it is the duty of the foreman to follow up; that is, when checking on the quality of his work he should also check on how safe he is performing his work.

It is assumed, of course, that the foreman already has the older employees lined up and working safely. If there are any objectors he has the authority to enforce the safety rules and should do so without respect to persons or length of service. Of course, obedience to safety rules in the performance of work should be brought about in a spirit of helpfulness and co-operation to the fullest possible extent but experience shows that certain types violently object to any kind of safety suggestion and it is the duty of the foreman to handle these cases and convert them—he must not shirk this duty or his entire safety program will collapse.

One of the most effective methods of keeping safety alive and an active subject is to hold group discussions. Every foreman should get his employees together at least once a week and conduct a brief departmental safety meeting and let the employees make suggestions and discuss unsafe practices and other conditions that might prevail in the department. During these meetings is the ideal time to get careless and reluctant employees lined up.

Good housekeeping is important and essential to a good safety record. Foremen should see that material in their departments is kept in safe condition and a location where it will not present a hazard to employees moving about in the department, that floors are kept clean to avoid falls from slipping or stumbling.

If it is not company policy to insist on employees wearing safety shoes the foreman should encourage those under his supervision to purchase and wear this type shoe.

If one of his employees is injured, the foreman first of all should see that the injured party receives the proper first-aid attention and is then taken to the doctor or the hospital if the injury is of a serious nature and requires further attention. After this is done the foreman should immediately investigate the location of the accident, the machinery or tools involved, talk to all witnesses and get all the facts pertaining to how the accident happened and what could have been done to prevent it. As soon as possible after the accident, or when the injured party returns to work, these facts should be presented to him and discussed in the presence of one or more members of the shop safety committee from his department. Any carelessness on the part of the injured employee should be called to his attention—or if the accident was due to lack of knowledge on the part of the injured employee he should be informed as to proper handling as a means of preventing recurrence. The facts developed from this procedure should be presented to all employees in the department at the weekly safety meeting to give them the benefit of this one man's experience.

The foreman can and should pass some of this responsibility on to his safety committee but must not lose sight of the fact that he, as the supervisor of the department, is directly responsible for conditions in that department. It is the attention he gives or does not give to safety matters that is going to bring about either a good or a poor safety record.

E. A. Greame,
Chairman

The Influence of Modern Cutting Tools

Carbides have demonstrated how to cut production time and increase tool life—Old machines not too well adapted to their use

During the years 1944 and the first half of 1945 the railroads of the United States went into the market for machine tools in greater quantities than at any time in the past 20 years. The experience, during the war years, of trying to keep up with the ever-increasing demand for production of locomotive repair parts taxed the older machine tool equipment of the average shop to its very limit of capacity and demonstrated the need not only for machine tool units of greater capacity but of machine tools that are designed to take advantage of the many new developments in modern cutting tools.

This committee, in 1941, embarked on a program of recording the progress of the use of modern cutting tools in its report on this subject in that year and there was every indication that the railroads were taking advantage, to the limit of their ability, of these new developments as opportunity afforded. In successive years the committee has followed up the investigation and reports have been presented recording the progress that has been made.

Realizing that the removal of some of the wartime restrictions that had made the procurement of new machine tools and tooling equipment difficult were actually being reflected in considerable activity in the field of shop equipment it was believed that this year's questionnaire should be productive of more comprehensive data than had been previously received for inclusion in this report. With that thought in mind questionnaires were directed to the

Machine Operation Data—Locomotive Parts

		Machine tool data					With cutting tools formerly used					With cutting tools now used				
Road Symbol	Name of part and material	Capacity; make; type	Age, yrs.	Motor, hp.	Machine condition	Description of operation	Tool used	Speed, f.p.m.	Feed, in.	Time per piece, h.m.s.	No. pcs. per tool grind	Tool used	Speed, f.p.m.	Feed, in.	Time per piece, h.m.s.	No. pcs. per tool grind
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A-1	Engine truck tire—24-in. bore	50-in. Bullard vertical turret lathe	23	15	Fair	Bore	High-speed steel	12	.018	2-30-00	½	Kennametal	38	.018	1-12-00	1
A-2	Exhaust nozzle, cast iron	50-in. Bullard vertical turret lathe	23	15	Fair	Face	High-speed steel	17	.011	0-49-00	6	Kennametal	54	.011	0-18-00	6
B-1	Driving box brass	48-in. Bullard vertical turret lathe	16	20	Good	Bore	High-speed steel	150	.040	0-45-0	5	Carboloy	250	.040	0-25-00	96
B-2	Cylinder bushing, cast iron	54-in. Bullard vertical turret lathe	16	15	Good	Turn, bore	High-speed steel	8 r.p.m.	.125	12-0-0	1	Carboloy	12 r.p.m.	.125	8-0-0	10
C-1	Rod bushing, gun iron	24-in. Bullard vertical turret lathe	1	15	Good	Turn, bore, face	Stellite	68	.027	2-10-0	1	Carboloy	156	.027	0-58-0	4
C-2	Rod bushing, bronze	24-in. Bullard vertical turret lathe	1	15	Good	Turn, bore, cut-off	Stellite	190	.062	1-30-0	6	Carboloy	450	.032	0-40-0	15
C-3	Bronze pin, 1¾ in. x 5 in.	2½-in. Gisholt turret lathe	3	10	Good	Turn, cut-off	Rex AA	152 r.p.m.	.011	0-4-15	50	Kennametal	500 r.p.m.	.016	0-2-0	200
D-1	Driving tire, 72 in.	96-in. King boring mill	20	25	Good	Bore	High-speed steel	76	.015	2-0-0	1	Vascoloy	160	.015	0-58-0	20
D-2	Motion bushing	14-in. Monarch engine lathe	7	—	Good	Rough	Cobalt	160	.015	0-1-50	2	Vascoloy	280	.015	0-0-50	40
						Finish	Cobalt	160	.015	0-1-50	2	Vascoloy	280	.015	0-0-50	40
D-3	Floating rod bushing	24-in. Bullard vertical turret lathe	25	7½	Fair	Rough	Stellite	180	.028	0-3-20	1	Vascoloy	250	.028	0-2-15	40
						Finish	Stellite	180	.014	0-6-35	1	Vascoloy	250	.014	0-4-45	40

attention of individuals who are members of the association on a total of 29 railroads, 17 of which are eastern railroads and 12 western roads. The returns from this questionnaire were disappointing, particularly from the western roads, and the committee can only assume that the pressure of responsibilities, just prior to the actual end of the war and its immediate after effects, was a most important factor in the lack of data furnished. That furnished by the few roads that replied is tabulated in the accompanying table and shows some of the comparative performances on several important locomotive machining operations.

There are three general observations that may be made from the limited amount of data shown in the table. First, a comparison of the performance between the new machines that are shown and some of the older machines that are still in service emphasizes the important fact that much higher cutting speeds can be used and, as a result, the production time can be lowered. Second, that the older machines do not have the capacity—in most cases due to inherent design—to utilize modern cutting tools to their utmost and that, at best, on many old machines a compromise must be made. This compromise is usually made because the older machine either does not have the power or the speed range to perform with new cutting tools in accordance with the recommendation of the manufacturer. Third, one of the major advantages of most of the modern cutting tools is tool life—the number of pieces between tool grindings. Many of these new cutting tools have inherent characteristics which depend upon operation at certain speeds in order to obtain the desired finish of the machined parts and to obtain the tool life that should be expected. When these tools are used on many of the older machines, which, in some cases, do not have sufficiently high top speeds, both finish and tool life must be sacrificed to some degree.

There is one other observation that may be appropriate in a report on this subject. Due to a variety of conditions, some of which are directly related to the ability of machine operators and the supervision over machine operators, many of the new machines that have been installed in railroad shops within the past year are not being utilized to their capacity. In most cases it can be assumed that in requesting the authority to purchase a new machine the shop tool committee estimated the savings to be expected on the basis of the production performance which the manufacturer guaranteed for the machine. If every effort is not made to follow the recommendations of the manufacturer both as to tooling equipment and methods as well as to the actual operation of the machine the expected economies will not be forthcoming.

A case in point which was recently observed was in connection with the production of tapered bolts on a turret lathe installed in a shop at a cost of over $20,000. This machine was turning out a 1⅝-in. by 8-in. taper bolt in slightly over four minutes per bolt (not including the threading operation). The factory demonstrator, on this same machine, was able by proper tooling and proper operation of the machine to produce bolt after bolt in less than 90 sec. and because of the proper tools and speeds these botls were far superior in finish and accuracy of size. In addition, the life of the tools was over twice as many pieces per tool grind.

The members of the committee were E. A. Greame (Chairman), tool foreman, D. L. & W.; Wallace Brown, shop supervisor, B. & M.; Wm. Leys, general machine foreman, G. T. W.; J. I. Stewart, supervisor shop machinery and tools, N. Y. C., and H. C. Wilcox, associate editor, *Railway Mechanical Engineer*.

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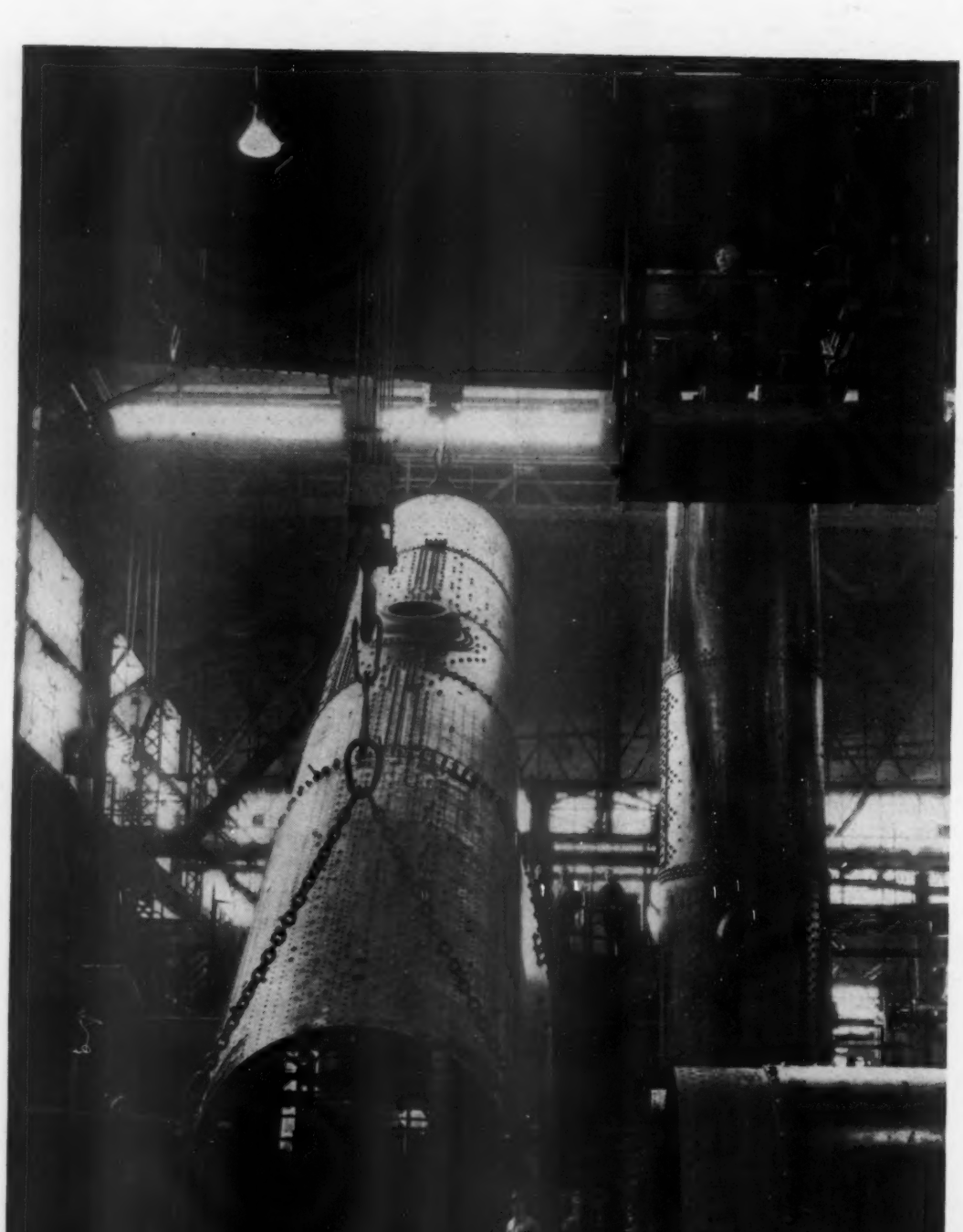


The Master Boiler Makers' Association

Five committees active in 1945 and submit reports — Interest in all-welded boilers continues

FIVE committees of the Master Boiler Makers' Association have continued their studies of matters of interest to the Association's membership during the past year, the fourth in which no member meeting could be held. There is space in this issue for the presentation of only one of the reports, the others will be published later in either complete or abstracted form. All will be published in their entirety in the 1945 year book of the association. The committees dealt with the construction of locomotive boilers of the all-welded type; the treatment of boiler feedwater; cinder cutting; application of staybolts, and the application and maintenance of flues and tubes. The report on all-welded boilers published here presents a comprehensive review of the developments in this field which have so far taken place. It then sets forth complete specifications for the construction of welded boilers as they are now to be built.

The officers who served during 1945 will continue in office for the coming year. They are: President, Myron C. France, general boiler foreman, C. St. P. M. & O.; vice-president, Frank A. Longo, general boiler inspector, Sou. Pac.; secretary-treasurer, A. F. Stiglmeier, general supervisor boilers and welding, N. Y. C. Members of the Executive Board who will continue to serve are Frank A. Longo (chairman), general boiler inspector, S. P.; Frank Yochem (secretary), general boiler inspector, Mo. Pac.; W. H. Keiler, I. C. C. locomotive inspector, Bureau of Locomotive Inspection, Interstate Commerce Commission; E. E. Owens, general boiler inspector, U. P.; B. C. King, general boiler inspector, No. Pac.; Edward H. Heidel, general boiler foreman, C. M. St. P. & P.; R. W. Barrett, chief general boiler inspector, Can. Nat'l.; Sigurd Christopherson, supervisor boiler inspector and maintenance, N. Y. N. H. & H. and E. H. Gilley, general boiler foreman, Grand Trunk. The members of the Advisory Board, who will also continue to serve are: E. R. Battley, chief of motive power and car equipment, Can. Nat'l.; B. M. Brown, general superintendent of motive power, Sou. Pac.; E. L. Grimm, general mechanical superintendent, Nor. Pac.; F. K. Mitchell, assistant general superintendent of motive power and rolling stock, N. Y. C., and H. H. Urbach, mechanical assistant to vice-president, C. B. & Q.

More All-Welded Boilers to Be Built

Approval obtained by roads in United States and Canada to construct four welded boilers— Standard procedural specifications are set up

E. H. Heidel, Chairman

The committee appointed to report on Topic No. 1 "Proposed Planning and Fabrication of Postwar Locomotive Boilers With X-Ray Development," has endeavored to obtain information on the subject from many and widespread sources for use in compiling its report containing recommendations for postwar locomotive boilers, in particular those of the all-welded type.

The planning and fabrication of postwar locomotive boilers should and must be given attention in these days, when there is so much discussion about lightweight, high-speed and higher-pressure locomotive boilers. Planning will depend upon the requirements. If we are to think of a boiler that must compete with other sources of power, we must consider the steam locomotive as a whole and its comparison with other types of power. It is improbable that any one design of boiler will meet all needs but the postwar boiler should embody all of the proven advances in design, materials, construction and practices which are best adapted to use in meeting the service requirements.

The D. & H. Welded Boiler

There is no question but that much study has been given the all-welded locomotive boiler by the railroads and the locomotive builders since the year of 1937 when the all-welded boiler was discussed at our annual meeting, and published on pages 91 to 94 and 98 to 99 inclusive of our 1937 annual proceedings covering the

all-welded locomotive boiler built by the American Locomotive Company for the Delaware & Hudson.*

Your committee feels that no report on this all-welded boiler would be complete without progress and data information, and G. S. Edmonds, superintendent of motive power, D. & H., has again cooperated with the committee in furnishing this information to August 31, 1945.

(Mr. Edmonds' report detailed the early history of the boiler while it was used as a stationary boiler in accordance with the requirement made by the Bureau of Locomotive Inspection when authority for construction was issued. After the boiler was put into locomotive service it received quarterly inspections with the jacket and lagging removed. Test pressure of 225 lb. was applied for the first three of these inspections. No leaks were found. The next two inspections were made with 340 lb. pressure, and the succeeding two with 350 lb. pressure. No leaks were found. In July, 1941, during the boiler's fourth year in service and in July, 1942, during its fifth year, the boiler was carefully examined and tested and the welding of the shell, wrapper and firebox sheets found to be in good condition. There were no leaks.

In July, 1943, the D. & H. was notified by the Bureau of Locomotive Inspection, "With reference to hydrostatic test to be applied to boiler of locomotive No. 1219, will advise that in the future, compliance with Rule 17 will be satisfactory; that is, hydrostatic test 25 per cent above working pressure." In August, 1943, the locomotive received classified repairs at the Colonie shops at which time firebox throat and flue sheets were applied at a mileage of 304,000. A check of 17 other locomotives of the same class showed an average life for these sheets of 193,000 in conventional riveted boilers. As of August 31, 1945, the locomotive had made 381,000 miles without any boiler trouble.—EDITOR.)

Because of the successful performance obtained from the D. & H.'s all-welded locomotive boiler, the Master Boiler Makers' Association selected, in the year 1944-1945, a committee to give study to the fabrication of postwar locomotive boilers, particularly of the all-welded type. They had already given similar attention to riveted construction in the past. In the year 1944 this committee reported an all-welded and semi-welded locomotive boilers. This report is published on pages 40 to 62, inclusive, of our 1944 proceedings.†

* See *Railway Mechanical Engineer*, October 1937 p. 501 for the text of this report which describes the construction details of the boiler.

A Builder Speaks

In a paper presented by James Partington, manager, engineering department, American Locomotive Company, at the March 19, 1945, meeting of the Northwest Locomotive Association, St. Paul, Minn., he said, "Railroads themselves must become proponents of welded boilers before this type of construction can become, I will not say standard, but even generally accepted."

"The Interstate Commerce Commission has cooperated with the railroads in the development of welded boilers and followed closely the service of the experimental welded boiler on the D. & H.

"The Bureau of Locomotive Inspection is fully conversant with the construction details and has complete information on the test requirements that have to be met in the building of welded locomotive boilers.

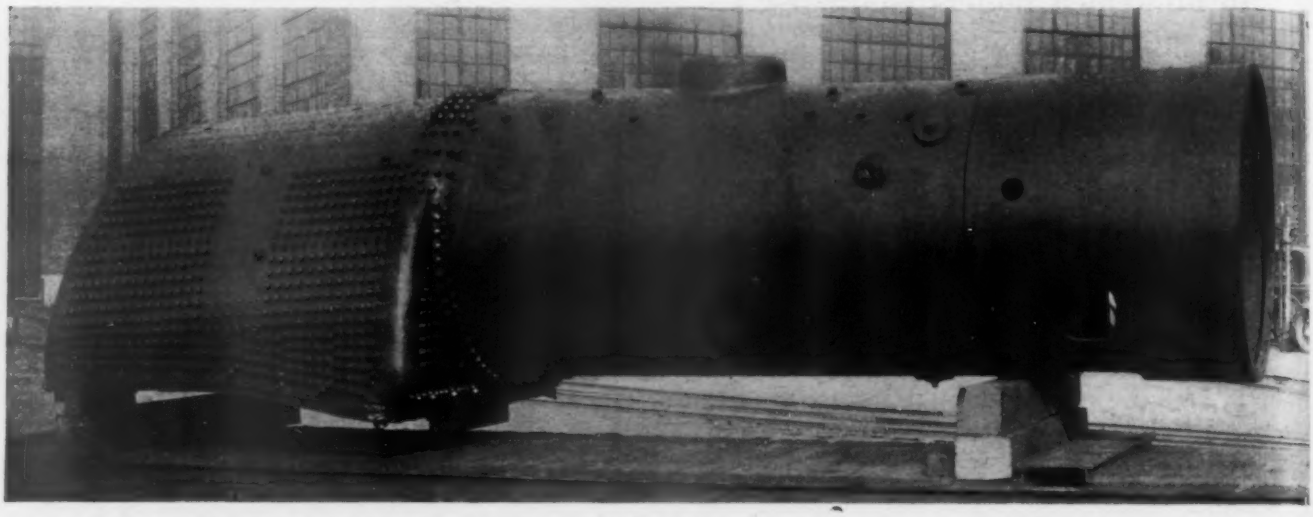
"We know that they will give careful and prompt consideration to all requests for permission to install and operate such boilers on locomotives which come under their jurisdiction.

"Electric arc welding, gas welding and forge welding were in use to a partial extent in the construction of new locomotives and repair of locomotives that were in service in the early part of the 1910 decade.

"On new work butt welds in locomotive fireboxes were made first with oxy-acetylene and later by electric-arc welding, using bare wire electrodes. The methods were used when maintenance in service required the application of patches in locomotive fireboxes. All of these welds were in the staybolted areas of the firebox and usually gave satisfactory results, the welds being supported by other means. In some railroad shops repairs were made to the shell portion of locomotive boilers by electric arc welding, the welds being made from the outside only.

"These welds were not stress-relieved, and would not meet the test requirements of present-day codes, nor the procedure rules of the American Welding Society. They were generally unsatisfactory, new cracks soon developed when the locomotives were put back into service.

"This was not the only kind of repairing which was done by electric arc welding. It was used extensively as a repair tool, sometimes with undesirable results. The



The original all-welded boiler as it was received from the builder's shop in 1937—It has been in locomotive service since September of that year and has given complete satisfaction

† See *Railway Mechanical Engineer*, November 1944, page 490.

F. A. Longo

Myron C. France

A. F. Stiglmeier

Officers
Master Boiler Makers' Association
1944-45

President: *Myron C. France, general boiler foreman, Chicago, St. Paul, Minneapolis & Omaha, St. Paul, Minn.*

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E. L. Grimm, general mechanical superintendent, Northern Pacific, St. Paul, Minn.

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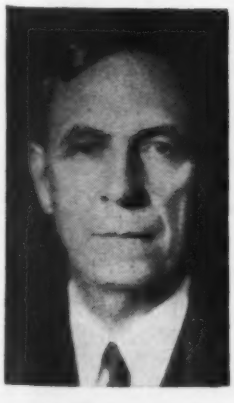
H. H. Urbach, mechanical assistant to executive vice-president, Chicago, Burlington & Quincy, Chicago.

E. R. Battley

B. M. Brown



E. L. Grimm

F. K. Mitchell

H. H. Urbach

use of this welding on boiler shells gave results which were not what might have been hoped for.

"These conditions caused the Bureau of Locomotive Inspection of the Interstate Commerce Commission to issue orders prohibiting all welding on the pressure parts of locomotive boilers and only permitting welding in the fireboxes as above outlined, with the provision that no firebox welds would be allowed higher than 14 in. below the top of the crown sheet.

Development of Welded Boiler Code

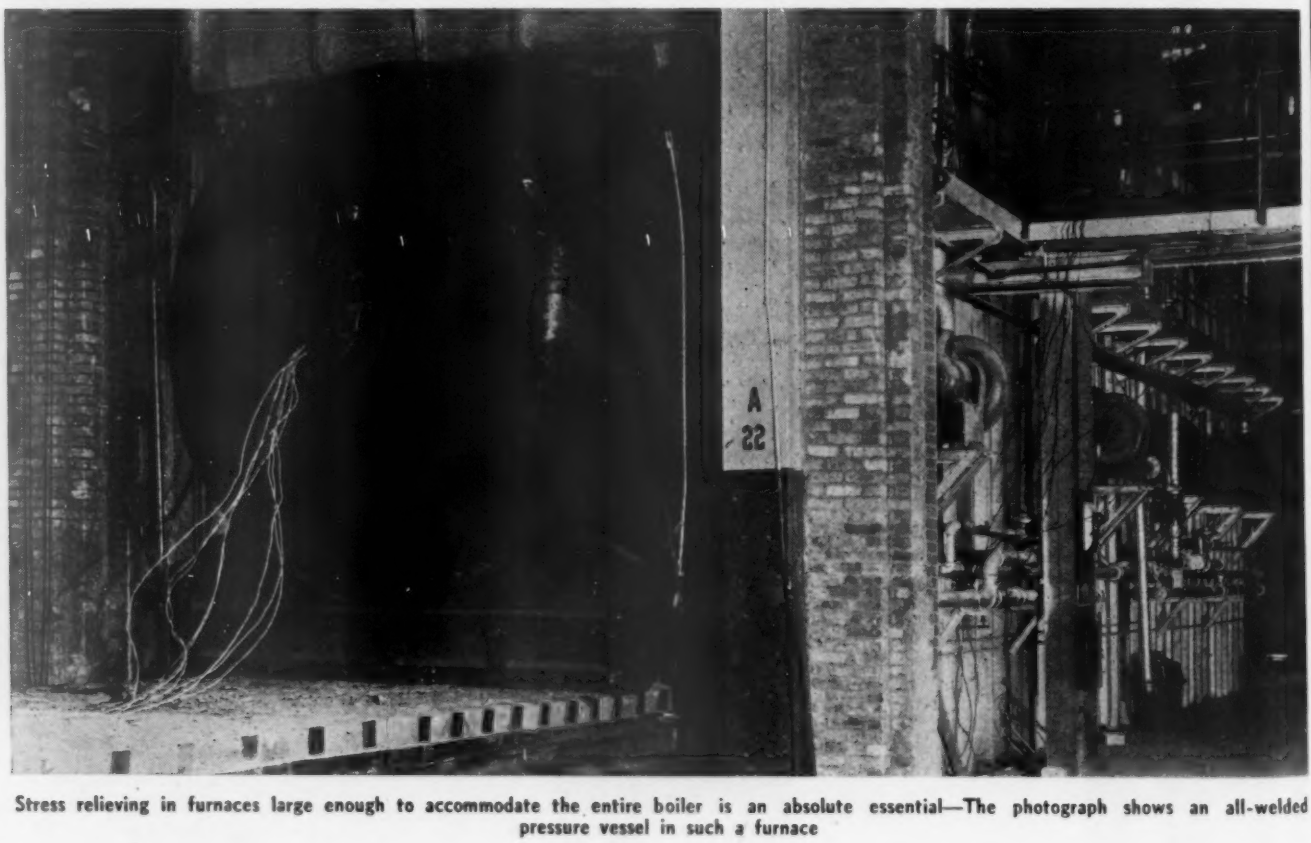
"The increasing use of welded construction in boilers and pressure vessels was noted with interest by the Boiler Code Committee of the A. S. M. E., and it was further emphasized when a request was received early in 1918 from the National Welding Council, which later merged with the American Welding Society, for affiliation with the A. S. M. E. in making a study of the subject. At its meeting on March 28, 1918, the Boiler Code Committee appointed a sub-committee on welding to draft rules for safe welding practice. In doing that, the usual practice of the committee was followed.

"The members of this committee represented a reasonably complete cross-section of the welding industry, i. e., electric arc welding, gas welding, and forge welding as used in railroad, power plant, gas storage, and refrigeration equipment.

"In January, 1920, the Boiler Code Committee requested the American Welding Society, which had been organized early in 1919, to appoint a conference committee to work with the Boiler Code Subcommittee in drafting a set of welding rules. This proved to be a difficult task which required four to five years of intensive effort by the two committees.

"The welding code was finally adopted and first issued for use in the first edition, 1925, of the Code for Unfired Pressure Vessels. The welding code rules were added to the code for power boilers in 1931 and in the code for boilers of locomotives in 1942. This welding code and the American Welding Society rules for the qualification of welding procedure and the qualification of welders have been most helpful in pointing the way for the very marked improvement that has taken place in all kinds of welding and in all types of welded construction.

Weld test plates are attached to shells

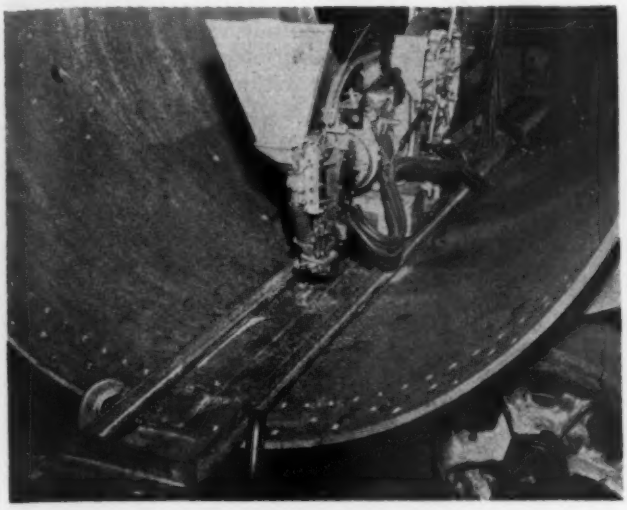


Stress relieving in furnaces large enough to accommodate the entire boiler is an absolute essential—The photograph shows an all-welded pressure vessel in such a furnace

"From the request by the Mechanical Committee of the A. A. R. it was evident that some railroads were getting to a point where they wanted to have welded boilers and wanted the rules in the code for locomotive boilers.

"These codes are written on the basic requirements of definite test results and this method has proved satisfac-

tory and adequate for all types of welding. The early discussions of the committee which was given the job of drafting the rules showed that those rules would have to be as devoid of procedure qualifications as pos-



Submerged-melt welding assures a uniformly good weld if procedures are correct and fit-up good

sible because the different types of welding in use at that time had proponents who were particularly enthusiastic about their type of welding and not enthusiastic about other types. For instance, forge welding was in use, had been recognized by the Boiler Code Committee and given a moderate value. They claimed their method as 100 per cent. Electric arc welding also claimed 100 per cent. Gas welding people knew their welding was 100 per cent. So the committee came to the conclusion that the only way rules could be drawn was to base those rules on required test results. That is the way the code was written, that is the way it stands now. It is a method that covers the situation and has general approval.

Railroads' First Welded Boiler

"In the railroad field one of the results of this progress in welding was the building of a welded boiler for a locomotive. The Bureau of Locomotive inspection of the Interstate Commerce Commission permitted the application and use of one completely welded boiler on a Consolidation-type freight locomotive of the D. & H.

"This boiler was built in accordance with the rules of the A. S. M. E. boiler code for power boilers, and the design and construction procedure were approved by the Mechanical Division of the A. A. R., the code of power boilers being taken because there were then no code rules for the welding of locomotive boilers in Section 3 of the code. This boiler has been in successful operation on the D. & H. for nearly seven years. By successful operation I mean that no flaws, cracks, leaks, or any imperfections of any kind have developed in the welded seams, and the parent metal of the boiler has not developed any cracks, so the boiler has required no repairs, no riveted patches, and still stands today a 100 per cent example of a welded boiler in service doing the job without any repairs being necessary.

"Before this boiler was installed on a locomotive for road service, the I. C. C. stipulated that it should be set up as a stationary boiler and operated for six weeks. That was done. Then it was mounted on a locomotive and examined every three months for the first year. All the welded seams were carefully gone over. The second year the same procedure was followed every six months. And subsequent to that, the boiler has been examined yearly. It has been 100 per cent clear of any leaks.

Welded Boiler Advantages

"No additional completely welded boilers for locomotives have yet been built but a number of railroads at the present time wish to put welded boilers in service. Some of the advantages to be gained by the use of welded boilers for locomotives are:

"1. The elimination of riveted joints which are likely to have some seepage between the boiler plates even when the best possible fabricating technique is employed.

"2. Elimination of boiler leaks, removing the possibility of cracked sheets which are frequently a major item of maintenance cost especially when high boiler pressures and high operating speeds are involved.

"3. The smooth contour of a welded boiler permits a much easier and an all-'round more satisfactory application of the boiler lagging and jacket, and provides the same smooth surface on the inside which contributes to easier and more satisfactory washouts.

"4. On many modern locomotives the saving in weight of the welded design versus the riveted job is an important item. This saving will vary with the size and type of locomotive and may be from 3,000 lb. to 6,000 lb. for a boiler alone with some small incidental additional saving in weight of lagging and jacket.

"5. The saving in maintenance costs with a welded boiler is likely to be an important item. Take for example the D. & H. boiler which has been in service six and a half years with no shell repairs.

All strength welds must be X-rayed

"You are no doubt questioning how practically 100

per cent welding is attained. The necessary steps to obtain this result are generally:

"1. The qualification of the shop welding technique, apparatus, electrodes, plate material, etc., by the production of the test specimens that meet the code requirements for Welding Procedure. These specimens must meet the tests for tensile strength, elongation, soundness of the weld metal, etc.

"2. The qualification of the welding operators using the welding procedure that has been approved. These tests are specially devised to determine the operator's ability to produce sound welds in the positions involved in the actual welding of the boiler. This is the groundwork or preparation carried out before the job is started. Test specimens must be furnished for each boiler and these specimens must meet all of the requirements.

"3. All of the strength welds must be X-rayed and must show the required degrees of soundness, freedom from inclusions or porosity.

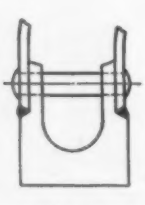
"4. After the welded boiler has passed the X-ray examination successfully it is stress-relieved in a furnace of sufficient size to take the boiler as a unit. This furnace must be under pyrometer control and must show a closely uniform temperature at all points. The test specimens are subjected to the same heat treatment, preferably with the boiler.

"5. After the firebox has been applied and the boiler completed, a hydrostatic test pressure of one and a half times the working pressure is applied and under this pressure all of the welds are subjected to a hammer test.

"In the fabrication of a welded boiler nothing is left to chance, all of the code rules are carefully followed and the result obtained can reasonably be expected to be approximately 100 per cent. In the manufacture of a welded boiler the welding process must be the proper one for the material being welded. Alloy steel requires a different procedure from that employed in welding ordinary carbon steel boiler plate of 55,000 lb. tensile strength. High-carbon, high-tensile steel also requires a different procedure.

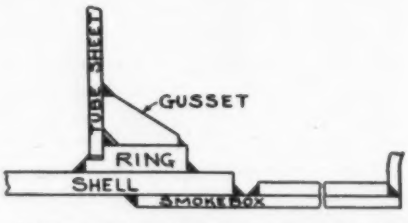
"In the fabrication of the D. & H. welded locomotive boiler there were several interesting design features. The attachment of the front tube sheet is one. This is designed for easy removal if a new tube sheet should be needed during the life of the boiler. The attachment of the dome of this boiler was a very special construction.

"Since the welding codes were issued the amount of welded construction has increased tremendously and greatly improved welding is the rule rather than the exception. In the earlier stages of welding, hand welding prevailed generally throughout the industry. Today, machine welding is very extensively used.



FIREBOX RING TO BACKHEAD AND FIREBOX BACK

LONGITUDINAL WELD



TUBE SHEET AND SMOKEBOX CONNECTION

Connection details used in first all-welded D. & H. boiler

215 Partially-Welded Boilers

"The American Locomotive Company on one order recently produced 100 boilers with the barrel courses welded longitudinally instead of a riveted joint with inside and outside welt straps. These longitudinal joints were machine welded by the submerged process, then X-rayed and stress relieved. Extremely little cutting out of weld material was required. We have since supplemented that program with another 115 locomotives on which the barrel courses have the longitudinal seam welded and no inside and outside weld straps. A recent report from our welding supervisor was that on nineteen sets of boiler courses just welded no cutting out was necessary.

"Cutting out is required when the X-ray shows any flaws or inclusions that are of sufficient amount to make replacement necessary to meet code rules. In the locomotive code up to this time, the value assigned to a joint is 90 per cent. In the power code, they have increased that value to 95 per cent. This is allowable and safe because the quality of welding since the codes were first issued has improved wonderfully and the efficiency and accuracy of the X-ray examinations also have been wonderfully improved. There is a technique laid down for taking the X-ray picture which has gradually developed as the X-ray machines came more and more into practical use, so that today the X-ray of steel plate has become much more nearly an exact science, those who do the job and those who are employed in reading the pictures being specially trained for this work.

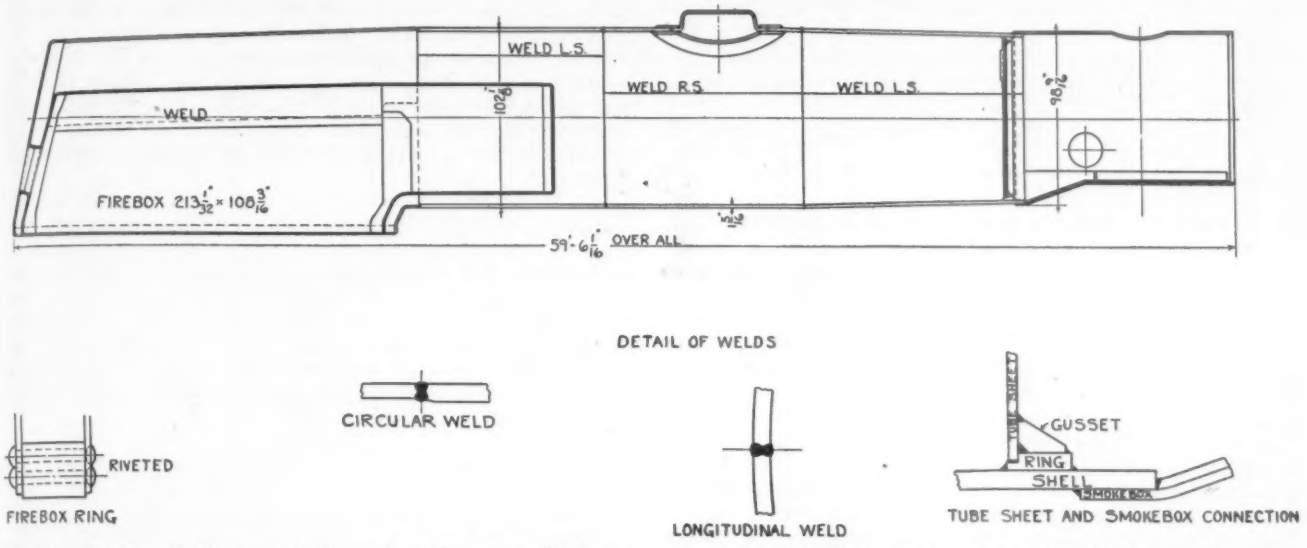
"The machine welding removes the human element encountered in hand welding, and if the procedure is correct a uniformly good weld is assured, provided the fitting up is all that it should be. In machine welding the fitting up of the job is a matter of utmost importance. Running a machine at 10 or 12 in. per min., the machine has no ability to judge whether there is a little more space between the sheets than is desired while in hand welding the feel of the job permits the operator to adjust such things. In machine welding the fitting up should be uniform throughout. If you have too much of an aperture you will burn through and have to cut out and re-weld.

"In fabricating several hundred shell courses of locomotive boilers with welded seams we have put the shop on a satisfactory production basis, but I do not think the locomotive builders are going to dispose of their bull riveters. I do think there are going to be a considerable number of welded boilers built for our railroads in the next few years, and that the welded boiler is going to be a very definite item in railroad service, coming into the picture gradually. I think it will solve a number of present-day railroad problems. Of the several hundred boilers referred to as having welded shell courses, the longitudinal seams only are welded, the courses being put together with circular seams of the usual riveted construction."

Government Agencies Approve More Welded Boilers

During the past year the railroads with the cooperation of the locomotive builders have designed an all-welded

locomotive boiler, following the A. S. M. E. code for locomotives, which was approved by the Mechanical Division of the Association of American Railroads prior to being presented to the Bureau of Locomotive Inspection, Interstate Commerce Commission and the Transport Commissioners for Canada for approval. Since the publishing of our 1944 Annual Proceedings, approval



Outline drawing of all-welded boiler to be built for application to a D. & H. 4-6-6-4 locomotive—Connection details are also shown

has been obtained from the Interstate Commerce and the Transport Commissioners of Canada for the construction of all-welded locomotive boilers as follows:

One for the D. & H. 4-6-6-4 type locomotive. This boiler has three barrel courses, the largest being 102⅛-in. o. d. with a shell thickness of 1 5/16 in. The overall length is 59 ft. 6 in.; working pressure, 285 lb.

One boiler for the New York Central, 4-6-4 type to replace a riveted-type boiler on a locomotive now in service. This boiler has three barrel courses, the largest being 92 1/16 in. o. d. with a shell thickness of 1 5/32 in. The overall length of this boiler is 44 ft.; working pressure, 275 lb.

Two boilers for the Canadian Pacific for 4-6-2 type locomotives. These boilers have three barrel courses, the largest being 75 13/16 in. o. d. with a shell thickness of 27/32 in. The overall length is 35 ft. ⅞ in. and the working pressure is 250 lb. These boilers are to be built by the American Locomotive Company.

Welding Closely Controlled

All of these boilers will be built to specifications covering construction which are approximately as given here.

Specifications Covering Construction of a Locomotive Boiler Having Fusion-Welded Boiler Shell

General: (1) This specification covers a boiler having a fusion-welded boiler shell; (2) where construction permits, all butt seams will be double welded; (3) wherever the term inspector is used in this specification, it shall mean the locomotive builders qualified inspector. Further inspection of all work by authorized inspectors of the purchaser, located at the locomotive builder's plant, is permitted; (4) all work will be done in the best and most substantial manner according to the true intent of the drawings and specifications; (5) only mechanics known to possess craftsmanship in accord with the specifications herein set out will be employed on this work; (6) operators who will do the manual welding will be qualified in conformance with requirements of A. S. M. E. code. The builder's automatic welding machine will produce a weld that has proved to be serviceable in steam boilers and has been accepted as such by responsible code authorities; (7) construction and application of all parts, except as specifically mentioned in connection with fusion welding, shall be in accordance with best recognized practice.

Materials: (8) All materials to be of the best quality of the respective kind for the purpose intended and to fully meet the requirements of this specification.

Boiler Shell Welding: (9) The process of welding in the construction of the boiler shell shall conform to the requirements contained herein as to radiographs, stress relieving, etc. The term boiler shell covers the barrel, manhole or dome, front tube sheet, outside throat, roof and sides, and backhead.

Factor of Safety: (10) The factor of safety of any joint made, tested and inspected in conformance with the requirements contained herein, shall be not less than 4½, based on a joint efficiency of 90 per cent of the lowest tensile strength of the plates. The factor of safety of all other parts shall be in conformance with the established laws, rules and instructions for Inspection and Testing of Steam Locomotives and Tenders and their appurtenances, issued by the Interstate Commerce Commission, Bureau of Locomotive Inspection, Transport Commissioners of Canada, and the A. S. M. E. Boiler Code for Welded Locomotive Boilers.

Welding: (11) The welding shall meet the following test requirements: (a) Test plates for longitudinal joints. A test

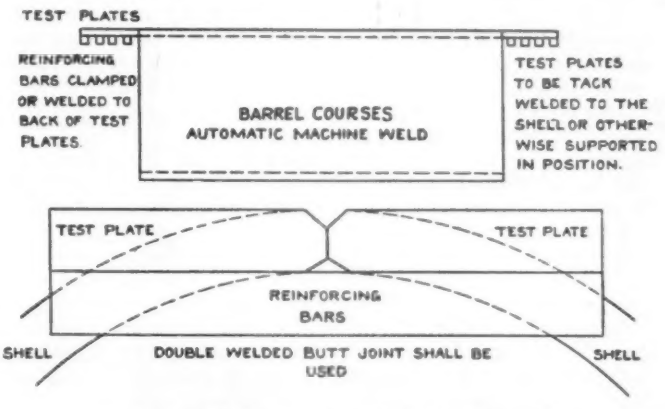

TEST PLATES
REINFORCING BARS CLAMPED OR WELDED TO BACK OF TEST PLATES
BARREL COURSES
AUTOMATIC MACHINE WELD
TEST PLATES TO BE TACK WELDED TO THE SHELL OR OTHERWISE SUPPORTED IN POSITION.
TEST PLATE
TEST PLATE
REINFORCING BARS
SHELL
DOUBLE WELDED BUTT JOINT SHALL BE USED
SHELL

Fig. 1—A method of forming longitudinal test plates

plate of the dimensions shown in Fig. 2 from steel of the same specifications and thickness as the barrel courses, prepared for welding, may be attached to the barrel course being welded, as in Fig. 1, on one end of the longitudinal joint of each course. A test plate of the dimensions shown in Fig. 2 from steel of the same specification and thickness as the wrapper sheet roof and wrapper sheet sides, prepared for welding as in Fig. 1 (2) may be attached to the wrapper sheet being welded, on one end of the longitudinal joint of each wrapper sheet. All test plates

so attached that the edges to be welded in the test plates are a continuation of and duplication of the corresponding edges of the longitudinal joint. In each case the weld metal shall be deposited in the test plates continuously with the weld metal deposited in the longitudinal joint. The plates for test samples

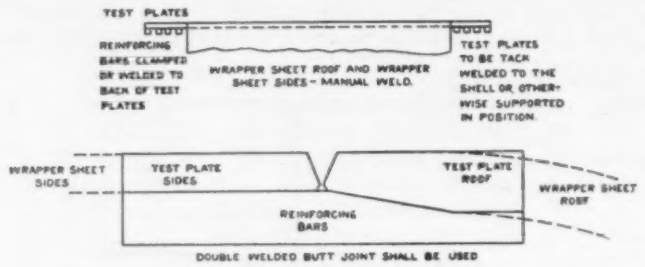

TEST PLATES
REINFORCING BARS CLAMPED OR WELDED TO BACK OF TEST PLATES
WRAPPER SHEET ROOF AND WRAPPER SHEET SIDES - MANUAL WELD.
TEST PLATES TO BE TACK WELDED TO THE SHELL OR OTHERWISE SUPPORTED IN POSITION.
WRAPPER SHEET SIDES
TEST PLATE SIDES
TEST PLATE ROOF
WRAPPER SHEET ROOF
REINFORCING BARS
DOUBLE WELDED BUTT JOINT SHALL BE USED

Fig. 1a—A method of forming longitudinal test plates

may be taken from any part of one or more of the same lot of material that is used in the fabrication without reference to the direction of mill rolling.

(b) Test plates for circumferential joints. When test plates are welded for the longitudinal joints, none need be furnished for circumferential joints in the same shell, provided the welding process, procedure and technique are the same.

(c) The test plates shall be so supported that warping due to welding shall not throw the finished test plate out of line by an angle of over 5 deg. Where the welding has warped the test plates, they shall be straightened before being stress relieved. The test plates shall be subjected to the same stress relieving operation, as required by Par. 16 A. S. M. E. code. At no time shall the test plates be heated to a temperature higher than that used for stress relieving the drum or shell.

(d) Test specimen. Coupons for tension and bend test determinations shall be removed from the welded test plate as shown in Figures 2 and 3. The coupons shall conform as nearly as possible to the dimensions shown in the figures.

(e) Tension tests. Two types of tension test specimens are required, one of the joint and the other of the weld metal. The tension specimen of the joint shall be transverse to the welded joint, and shall be the full thickness of the welded plate after the outer and inner surfaces of the weld have been machined to a plane surface flush with the plate.

The tensile strength of the joint specimen in Fig. 2 shall not be less than the minimum of the tensile range of the plate used. (The tension test of the joint specimen as specified herein, is intended as a test of the welded joint and not of the plate. If the specimen breaks in the plate and the weld shows no sign of weakness, the test may be accepted as meeting the requirements.)

The tension test specimen of the weld metal shall be taken entirely from the deposited weld metal and shall meet the following requirements: Tensile strength, at least that of the minimum of the range of the plate which is welded; Elongation, min., 20 per cent in 2 in. For plate thicknesses less than $\frac{5}{8}$ in., the all-weld metal tension test may be omitted.

(f) Bend tests. The bend test specimen shall be transverse to the welded joint of the full thickness of the plate and shall be of rectangular cross-section with the width of 1½ times the thickness of the specimen.

The inside and outside surfaces of the weld shall be machined to a plane surface flush with the plate. The edges of this surface shall be rounded to a radius not over 10 per cent of the thickness of the plate. The specimen shall be bent cold under free bending conditions until the least elongation measured within or across approximately the entire weld on the outside fibers of the bend test specimen is 30 per cent.

When a crack is observed in the convex surface of the specimen between the edges, the specimen shall be considered to have failed and the test shall be stopped. Cracks at the corners of the specimen shall not be considered as a failure. The appearance of small defects in the convex surface shall not be considered as a failure if the greatest dimension does not exceed $\frac{1}{16}$ in.

(g) Retests. Should any of the tests fail to meet the requirements by more than 10 per cent, no retest shall be allowed except that in the case of failure of the free bend test specimen due to permissible defects, free bend specimen retests may be allowed at the discretion of the inspector.

Should any of the tests fail to meet the requirements by 10 per cent or less, retests shall be allowed. A second test plate shall be welded by the same operator who welded the plate which failed to meet the test requirements. The retest shall be made on specimens cut from the second plate.

The retests shall comply with the requirements. For either of the tension retests, two specimens shall be cut from the second test plate, and both of these shall meet the requirements. When there are more than one specimen of the same type and when one or more of the group specimens fail to meet the requirements by 10 per cent or less, the retest shall be made on an entire group of specimens, which shall meet the requirements.

If the percentage of elongation of any tension test specimen is less than that specified and any part of the fracture is more than ¾ in., from the center of the middle third of the gauge length of the full size specimen as indicated by the scribe scratches marked on the specimen before testing, a retest shall be allowed.

(h) Non-destructive tests. All longitudinal and circumferential welded joints of the boiler shell shall be examined throughout their entire length by the X-ray or the Gamma-ray method of radiography. All welded joints to be radiographed shall be prepared as follows: The weld reinforcement on both the inside and the outside shall be ground, chipped and ground, or suitably machined to remove the irregularities of the weld surface so that it merges smoothly into the plate surface. The finished surface of the reinforcement may have a crown of approximately uniform amount not to exceed the following:

Plate thickness, in.	Thickness of reinforcement, in.
Up to ½, inclusive	$\frac{1}{16}$ maximum
Over ½ to 1, inclusive	$\frac{1}{16}$ to $\frac{3}{32}$
Over 1	$\frac{3}{32}$ to $\frac{1}{8}$

The films obtained by the use of X-rays shall be known as exographs and those obtained by the use of gamma-rays known as gammagraphs. Both types of films shall be generally termed radiographs.

The weld shall be radiographed with a technique which will determine quantitatively the size of defects with thickness equal to and greater than two per cent of the thickness of the base metal. To determine whether the radiographic technique em-

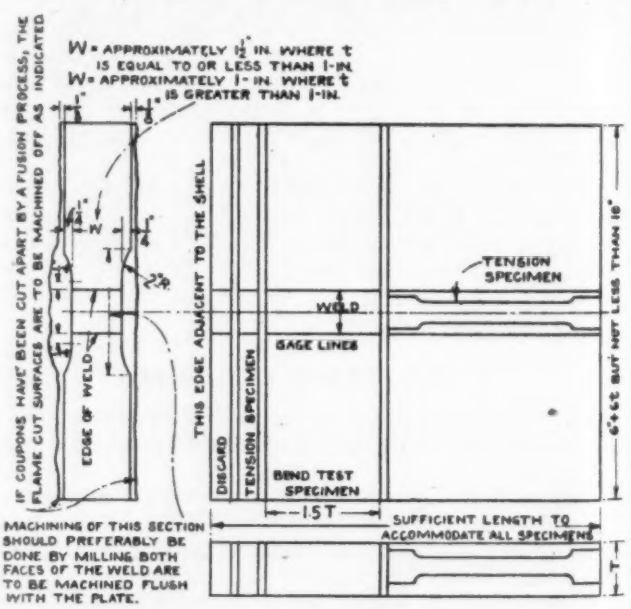

W = APPROXIMATELY ½ IN. WHERE t IS EQUAL TO OR LESS THAN 1-IN.
W = APPROXIMATELY 1- IN. WHERE t IS GREATER THAN 1-IN.
IF COUPONS HAVE BEEN CUT APART BY A FUSION PROCESS, THE FLAME CUT SURFACES ARE TO BE MACHINED OFF AS INDICATED
EDGE OF WELD
THIS EDGE ADJACENT TO THE SHELL
DISCARD
TENSION SPECIMEN
BEND TEST SPECIMEN
WELD
GAGE LINES
TENSION SPECIMEN
6"+6t BUT NOT LESS THAN 18"
1.5T
SUFFICIENT LENGTH TO ACCOMMODATE ALL SPECIMENS
T
MACHINING OF THIS SECTION SHOULD PREFERABLY BE DONE BY MILLING BOTH FACES OF THE WELD ARE TO BE MACHINED FLUSH WITH THE PLATE.

Fig. 2—The test specimen used for determining the strength of the welded joint

ployed is detecting defects of a thickness equal to and greater than two per cent of the thickness of the base metal, suitable thickness gauges or penetrameters shall be placed on the side of the plate nearest the source of radiation, and used in the following manner:

(1a) To determine whether the radiographic technique employed is detecting defects of a thickness equal to and greater than 2 per cent of the thickness of the base material, gauges or penetrameters of the following type shall be placed on the side

of the plate nearest the source of radiation and used as directed. The material of the penetrameter shall be substantially the same as that of the plate under examination. The thickness of the penetrameter shall be not more than 2 per cent of the thickness of the plates.

In each penetrameter there shall be three holes of diameters equal respectively to two, three and four times the penetrameter

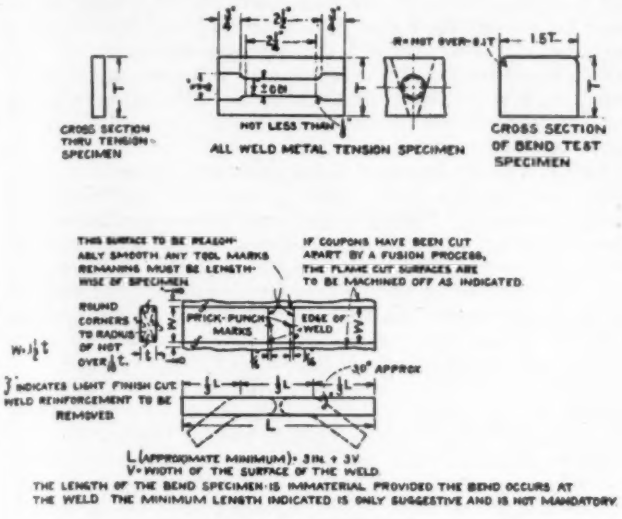

CROSS SECTION THRU TENSION SPECIMEN
NOT LESS THAN
ALL WELD METAL TENSION SPECIMEN
R = NOT OVER 6T
1ST.
CROSS SECTION OF BEND TEST SPECIMEN
THIS SURFACE TO BE REASONABLY SMOOTH ANY TOOL MARKS REMAINING MUST BE LENGTHWISE OF SPECIMEN
IF COUPONS HAVE BEEN CUT APART BY A FUSION PROCESS, THE FLAME CUT SURFACES ARE TO BE MACHINED OFF AS INDICATED
ROUND CORNERS TO RADIUS OF NOT OVER
PRICK-PUNCH MARKS
EDGE OF WELD
30° APPROX
INDICATES LIGHT FINISH CUT
WELD REINFORCEMENT TO BE REMOVED
L (APPROXIMATE MINIMUM) = 3IN + 3V
V = WIDTH OF THE SURFACE OF THE WELD
THE LENGTH OF THE BEND SPECIMEN IS IMMATERIAL PROVIDED THE BEND OCCURS AT THE WELD THE MINIMUM LENGTH INDICATED IS ONLY SUGGESTIVE AND IS NOT MANDATORY

Fig. 3—Test specimens

thickness, but in no case less than 1/16 in., except when gamma-rays are used as a source of radiation, the minimum hole need not be less than 3/32 in. The smallest hole must be distinguishable on the radiograph.

Each penetrameter shall carry an identifying number representing, to two significant figures, the minimum thickness of plate for which it may be used. The images of these identifying numbers shall appear clearly on the radiograph. For plates up to 2½ in. in thickness, each penetrameter shall be 1½ in. long and ½ in. wide as shown in Fig. 4. Two penetrameters shall be used for each exposure, one at each end of the exposed length, parallel and adjacent to the welded seam with the small holes at the outer ends. The film during exposure shall be as close to the surface of the weld as is practicable. The distance of the film from the surface of the weld on the side opposite the source of radiation shall, if possible, not be greater than 1 in. With the film not more than 1 in. from the weld surface, the minimum distance between source of radiation and the back of the weld shall be as follows:

Plate thickness, in.	Minimum distance from source of radiation to back of weld, in.
Up to 1	14
1 to 2	21

There should also be a plain indication on each film showing the job number, name of boiler part, and seam, as well as the manufacturer's identification, symbol or name. If it is necessary to expose the film at a distance greater than one inch from the weld, the following ratio of

$$\frac{\text{Distance from source of radiation to weld surface toward radiation}}{\text{Distance from weld surface toward radiation to film}}$$

should be at least 7 to 1. When a grid of the Buckeye type is employed, to reduce scattered radiation, the above ratio may be reduced to 5. These conditions are imposed so as to obtain a practical maximum allowable distortion and magnification of any defect in the welded seam.

All radiographs shall be free from excessive mechanical processing defects which would interfere with proper interpretation of the radiograph.

Identification markers whose image will appear on the film shall be placed adjacent to the weld and their location accurately established by the inspector. The radiographs shall be submitted to the inspector. If the inspector requests, the following data shall be submitted with the radiographs: the thickness of the base metal, the distance of the film from the surface of the weld, and the distance of the film from the source of radiation.

The acceptability of welds examined by radiography shall be judged by comparing the radiographs with a standard set, which reproductions may be purchased from A. S. M. E.

In general, the standard of judgment shall be:

(1b) Welds in which the radiographs show elongated slag inclusions, or cavities, exceeding the permissible limits, or zones of incomplete fusion, shall be unacceptable if the length of any such imperfection is greater than ⅓ T, where T is the thickness of the weld. If the lengths of such imperfections are less than ⅓ T and are separated from each other by at least 6L of the acceptable weld metal, where L is the length of the longest imperfection, the weld shall be judged acceptable if the sum of the lengths of such imperfections is not more than T in a weld length of 12 T.

(2b) Welds in which the radiographs show any type of crack of zones of incomplete penetration, shall be unacceptable.

(3b) Welds in which the radiographs show porosity shall be judged as acceptable or unacceptable by comparison with the standard set of radiographs. A complete set of radiographs shall be retained by the locomotive builder and kept on file for a period of at least 10 years. If at the expiration of this time the locomotive builder no longer desires them, they may then be turned over to the purchaser at their request.

Preparation for Welding: (12) The plates to be welded shall be cut to size and shape by machining or shearing, or by flame cutting. If shaped by flame cutting, the edges must be uniform and smooth and must be free of all scale and slag accumulations before welding. The discoloration which may remain on the flame cut surface is not considered to be detrimental oxidation.

The edges of the plates at the joints shall not have an offset from each other at any point in excess of one-quarter of the plate thickness at the joint with a maximum permissible offset of ⅛ in., for both longitudinal joints and girth joints.

In all cases where plates of unequal thicknesses are abutted, the edge of the thicker plate shall be reduced in some manner so that it is approximately the same thickness as the other plate. See Fig. 5.

In longitudinal shell joints the middle lines of the plate thickness shall be in alignment within the fabricating tolerances specified above.

The design of welded courses or shells shall be such that bending stresses are not brought directly upon the welded joint.

No single welded butt joint or fillet weld shall be used where a concentrated bending stress will occur at the root of the weld due to bending of the parts joined, unless the parts are properly supported independent of the welds. Corner welds shall be avoided unless the plates forming the corner are properly supported independently of such welds.

(13) (a) Longitudinal, circumferential and other joints uniting the plates of the boiler shell or other parts shall be of the

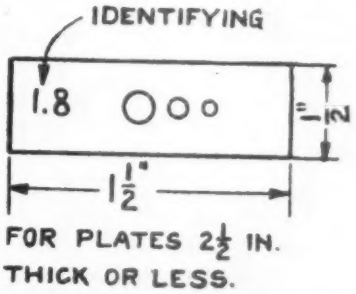


Fig. 4—Dimensions of penetrameters. The hole diameters are 2, 3 and 4 times the thickness of the penetrameter but not less than 1/16 in.

double-welded butt type and shall be reinforced at the center of the weld on each side of the plate by at least 1/16 in. up to and including ⅝ in. plate and up to ⅛ in. for heavier plates. The reinforcement may be removed, but if not removed shall be built up uniformly from the surface of the plate to a maximum at the center of the weld. Particular attention is called, however, to the importance of the provision that there shall be no valley or groove along the edge of or in the center of the weld, but that the deposited metal must be fused smoothly and uniformly into the plate surface at top of the joint. The finish of the welded joint shall

be reasonably smooth and free from irregularities, grooves or depressions.

(b) Heads concave to the pressure and plate edges at girth seams to be attached by butt joints shall be aligned so that the

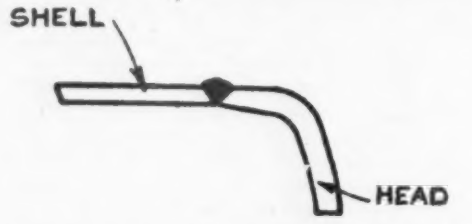


Fig. 5—Where plates of unequal thickness are joined the heavier plate is tapered to the approximate thickness of the lighter plate

deviations are not more than permitted by the limitations of Par. 12, but if greater, correction shall be made by reforming the shell or head, whichever is out of true, until the errors are within the limits specified. The edges of all double welded longitudinal and circumferential joints except those of the barrel courses are to be kept sufficiently separated at the point of welding to insure thorough penetration of the weld metal, as specified on the boiler drawing showing the preparation of the sheets for welding. The edges of the double butt welded longitudinal and circumferential joints of the barrel courses should be fitted together without separation, as specified for machine welding on the boiler drawing.

(c) Holes. The holes must not be located in any welded joint.

(14) The dome of the flanged one-piece construction is to be attached to the shell course in a manner similar to that shown in Figs. 6 and 7.

The weld joining the dome and shell course shall be subject to radiograph examination as covered in Par. 11 A. S. M. E. Code. The fillet weld joining the reinforcement to the shell course need not be subjected to radiograph examination.

Attachments to shell: (15) Pads for the insertion of studs, boiler check liners, washout plug bushings, and angles for dry pipe support may be welded to the shell. All other attachments to the shell shall be threaded, studded, or riveted, of ample strength to properly carry the load.

Stress Relieving: (16) The fusion welded boiler shell shall be stress relieved by heating uniformly to the proper temperature for the material used. The heating should be at the rate of 100 deg. F., per hr., with controlled cooling in the same manner. All connections attached by fusion welding shall be stress relieved. The structure shall be stress relieved by heating the complete boiler shell as a unit.

Distortion: (17) The cylinder or barrel of the shell shall be circular at any section within a limit ¼ in. on diameter, and if necessary to meet this requirement shall be reheated, rerolled or reformed. Tolerances for both longitudinal and horizontal alignment are to be maintained the same as is permitted for the boilers of riveted construction.

Inspection During Construction: (18) The inspector will witness the welding operation and inspect the welded joints, the shell in partly or wholly completed condition, the operation of stress relieving and the assemblage of other parts of the boiler at any or all stages as he may select.

Hydrostatic and Hammer Tests: (19) The fusion welded boiler shall be subjected to a hydrostatic test of one and a half times the designed pressure and while subject to this pressure all butt welded joints which are unsupported by other means, and all other welded joints where such a test is feasible, shall be given a thorough hammer or impact test. This impact test shall consist of striking the plate at 6-in. intervals on both sides of the welded joint and for the full length of all welded joints. The weight of the hammer in pounds shall approximately equal the thickness of the shell in tenths of an inch, but not to exceed 10 lb., and the plate shall be struck with a sharp swinging blow. The edges of the hammer shall be rounded so as to prevent defacing the plates.

Following this test, the pressure shall be maintained at not less than one and one-half the designed pressure and held there for a sufficient length of time to enable an inspection to be made of all joints and connections, after which the boiler shall be entered and the interior surfaces and connections examined as conditions will permit.

Pinholes, cracks or other defects shall be repaired only by chipping, machining, or burning out the defect to clear the metal and re-welding. This re-welding to be done before stress relieving so far as possible. For gas welding, the metal around the defects shall be preheated to a dull red for a distance of at least 4 in. all around. Any preheating means may be used, such as flange fire, gas or oil burner, or a welding torch. The preheating shall be done slowly, so the heat will get well back into the plate and expand it thoroughly. For metallic arc welding preheating or reheating is not required. After any repair welding, the area in the vicinity of the weld shall be stress relieved by heating to a dull red to equalize stresses and then cooled slowly. After repairs have been made, the boiler shall again be tested in the regular way, and if it passes the test, the inspector shall accept it. If it does not pass the test the inspector may order supplementary repairs, or, if in his judgment the boiler or other pressure part is not suitable for service, he may permanently reject it. The boiler to be absolutely tight at hydrostatic test.

Fire Test: (20) Draw off water to gauge level and fire up the boiler and test under own steam pressure to 20 per cent above designed pressure. Time to be consumed in raising required pressure to be from 2½ to 5 hr., depending on the water capacity, after which reduce the pressure to 50 per cent of designed pressure, then raise steam again to required pressure. The boiler to be made tight under this lowering and raising of the pressure. Leaks in welded seams must not be caulked. Blow-off steam pressure and then slowly drain the boiler of all contents.

Reinforcement of Openings: (21) All openings over 3¼ in. in diameter or/and exceeding four and a half times the thickness of the plate, in unstayed surfaces, must be suitably reinforced.

Firebox Welding: (22) The fusion welding of the internal firebox, where the stress is carried by other construction, and where the safety of the structure is not dependent upon the strength of the weld need not be stress relieved or radiographed.

Rivet Holes: (23) Rivet holes for attaching bracing, etc., to be drilled in the flat sheet at least 5/16 in. small and reamed to the exact size after the plates or parts are assembled to insure uniform holes, then slightly countersunk and the edges of the holes rounded to a 1/16-in. radius. The use of draft pins will not be allowed. Rivets to be driven hydraulically where possible.

Flanging: (24) The boiler and firebox plates to be hydraulically flanged, the reduction of cross-section to be a minimum.

Tube and Flue Setting: (25) Tube and flue holes in the tube sheets to have sharp edges removed from both sides of the sheet. The tubes and flues to be swedged to fit standard ferrules in the

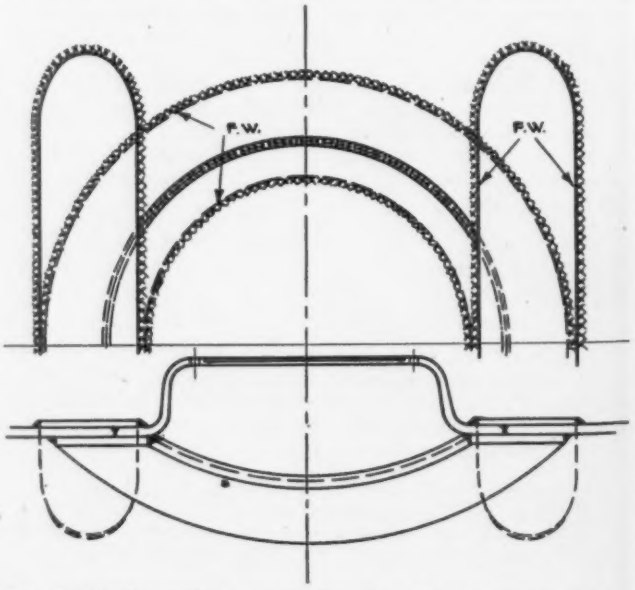


Fig. 6—Showing method of attachment of flanged one-piece dome to the shell course

firebox. No ferrules in the front tube sheet. Tubes to be rolled and beaded both ends.

Firebox Ring: (26) The firebox ring to be of solid rectangular cross-section of cast-steel single or double riveted.

Staybolts: (27) Maximum allowable stress per square inch of net cross-sectional area on the firebox stays at designed pressure shall not exceed 7,500 lb.

Braces: (28) Maximum allowable stress per square inch of net cross-sectional area on round, rectangular and gusset braces at designed pressure shall not exceed 8,500 lb.

Flexible Staybolts: (29) The welds attaching the flexible type staybolts having welded type sleeves or caps, used in the construction of this boiler, need not be stress relieved.

Other Welding: (30) Applications of fusion welding in construction of parts not specifically referred to in this specification

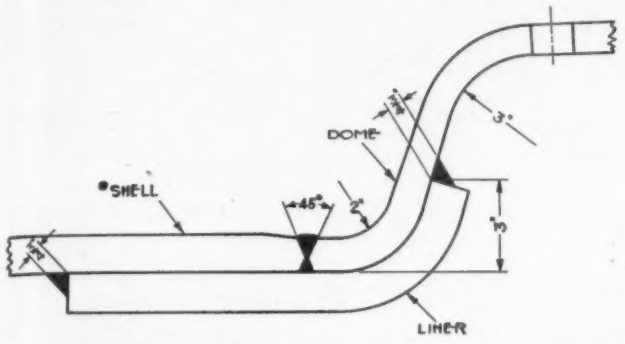


Fig. 7—Detail of a method of applying dome to an all-welded boiler

and applications of fusion welding in making repairs to any part of the boiler after the boiler is placed in use will conform to established practice in the application of repairs to locomotive boilers of conventional construction.

Material Specifications: (31) The following material specifications to be used—flange or boiler steel—A.S.T.M. Spec. A-201-Grade A, semi-killed suitable for welding by submerged weld process.

Firebox Steel: A.A.R. Spec. E-M 115, Grade A.

Tubes and Flues: Steel, A.A.R. Spec. M-108.

Staybolt Iron: Flexible bolts, rigid bolts, A.A.R. Spec. M-305.

Angles, Tees: A.A.R. Spec. E-M 116, Grade B.

Braces: Rod braces to S.A.E. composition 1022 or A.I.S.I. composition C 1022. Soft steel.

Rivets: Steel, A.A.R. Spec. M-110.

Steel Castings: A.A.R. Spec. E-M 201, Grade B.

Studs: Tube sheet studs for header casting, and cab turret studs, Society of Automotive Engineer's Spec. No. 1035 normalized and tempered.

Other Studs: Society of Automotive Engineer's Spec. No. 1020.

Recommendations

The committee is quite confident that boilers so constructed can and should be made a standard fabrication procedure. And further, the committee recommends in this report the all-welded type locomotive boiler.

The members of the committee are E. H. Heidel (chairman), general boiler foreman, C. M. St. P. & P.; A. F. Stiglmeier (vice-chairman), general supervisor boilers and welding, N. Y. C.; H. A. Bell, general boiler inspection, C. B. & Q.; F. C. Haase, general manager, Oxweld Railroad Service Company; J. H. Lewis, assistant general boiler inspector, A. T. & S. F.; A. G. Trumbull, chief mechanical engineer, C. & O.; W. R. Hedeman, engineer of tests, B. & O.; E. Magee, welding foreman, C. R. R. of N. J., and J. W. Kenefic, district superintendent, Air Reduction Sales Co.

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Electrical Section

Featuring
Electrical Shop Devices . . .

Cleaning Electrical Windings

By D. L. Gibson*

Suggested procedures for meeting the various kinds of cleaning requirements

THERE are several rather simple methods that can be used for cleaning windings, rotors and stators of electrical equipment and the one, or combination, to use depends upon the reason for cleaning the machine. Cleaning of apparatus and insulation goes beyond simply wiping off the surface with solvent; or removing old coils and scraping the slots free of varnish. Money, time and labor can be saved on cleaning and on subsequent operations if the jobs are analyzed and proper methods used.

Machines which are being rehabilitated by another varnish and ovenbake dip require a type of cleaning that will remove grease, dirt and carbon dust, but not damage the insulation. For stators or rotors which are to have the coils removed and then rewound, a method can be used that not only eliminates dirt and grease, but also softens the varnish film to facilitate removal of coils, cleaning of vent ducts, and of frames. Proper cleaning of laminations and slots can be achieved by still another method. In some cases machines may require special cleaning with water or solvents due to exposure to chemical fumes, salt water, or flood waters.

Fig. 1—Removing loose dirt from rotor winding with compressed air—Air pressure should be kept between 40 to 50 lb., otherwise there is danger of loosening insulation material

These examples indicate the need for careful analysis of the cleaning problem and of making provision for facilities to do the job economically. Usually, adequate temporary equipment can be installed to take care of the special cleaning necessary.

Standard methods of cleaning insulation include: wiping the parts with lintless cloths soaked with solvent; blowing the dirt out with air pressure; drawing the dirt off with vacuum cleaning apparatus; spraying or immersing in solvents; and washing with water. Specialized methods include the use of vapor degreasing and the use of the steam "jenny." The methods used will depend upon the varnish treatment of the apparatus and conditions involved.

Machines treated with asphalt base varnishes cannot be cleaned by vapor degreasing unless complete stripping and removal of varnish is contemplated. Low-powered solvents should be used on asphalt base varnishes if the film is not to be removed. Synthetic varnishes will stand more severe cleaning methods than asphalt varnishes without injury to the film.

Cores stripped for rewinding may be further cleaned by sand blasting, vapor degreasing or solvent immersion. This discussion applies to machines that may be dismantled to be cleaned or machines that can be taken to repair shops for an overhaul. The following methods do not apply to high voltage machines of 4,000 volts and over. These require special cleaning processes with low-powered solvents.

Blowing Out and Drawing Off Dirt

Blowing out dirt with air at about 40 to 50 lb. pressure is usually effective, particularly in inaccessible places as illustrated in Fig. 1. However, use of air merely removes the loose dirt, and does not disturb the embedded material. Cleaning can be done quickly with compressed air, however, the air should be dry and clean; the windings should not receive the full force of the air pressure. Equipment to be cleaned should be given a preliminary going over with air pressure to remove the loose dirt. Care should be exercised in using air, however, to prevent blowing dirt into cracks in the insulation. If vac-

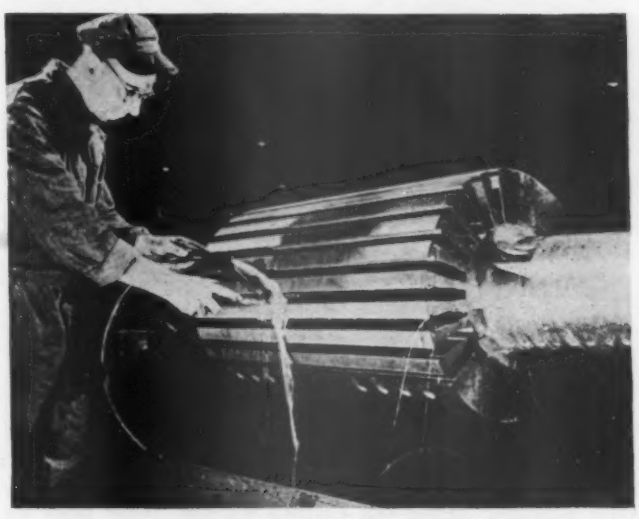


Fig. 2—Cleaning grease, oil metal chips and dirt particles from a slotted rotor with solvent—Note brush used to insure complete removal of contamination within slots

* Insulation engineer, Development Insulation Section, transportation and generator division, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Table I—Specifications for Standard Petroleum Solvents

Values	Xylene substitute	Mineral spirits	Naphthenic mineral spirits	High flash mineral spirits
Sp. gr. at 15.5 deg. C.	0.77-0.80	0.76-0.79	0.81-0.82	0.77-0.79
Pounds per gal.	6.4-6.7	6.3-6.6	6.7-6.8	6.4-6.6
A.S.T.M. distillation deg. F.				
Initial boiling point	290	305	310	325
50 per cent over	305	345	340	350
90 per cent over	315	370	370	370
Dry point	325	395	395	395
Kauri-Butanol value	36—47	31—40	42—46	34—36
A.S.T.M. flash point deg. F.	85	103	105	115

uum cleaning equipment is available it should be used, as it does a good cleaning job and in addition does not distribute the dirt around the shop.

Use of Solvents

When the accumulation of dirt on the frame and insulation contains oil and grease, an organic solvent will be required to remove it as shown in Fig. 2. Solvents for oil and grease can be applied by wiping with lintless cloths moistened with the cleaning fluid. Obviously, this method cleans only the readily accessible places. Pressure spraying or immersing the parts in a bath of the solvent reaches the inaccessible parts. The immersion method entails some hazard caused by the maintenance of tanks of solvent. However, small motors can be easily cleaned by hanging on racks and dipping in solvents.

These methods adequately clean the surface of the machine for repairs, or of the insulation for additional varnish treatment or for removal of a few coils. They do not clean out vent ducts, dissolve varnish, loosen coils in the slots, or clean slot laminations. The baked varnish film is rarely injured.

In general there are three types of organic solvents in use, for cleaning: (1) Petroleum distillates of low solvency power; such as mineral spirits or a high flash dry cleaning solvent known as Stoddard's solvent, or cleaner's naphtha; (2) petroleum distillates of a medium solvency power; such as naphthenic mineral spirits, and (3) carbon tetrachloride.

Typical analyses of several petroleum cuts are given in Table 1. Solvents are purchased to such specifications. Those for cleaning purposes should have flash points of approximately 100 deg. F. or greater and a solvency power (kauributanol value) in the range of 30-45. Such solvents are inexpensive. They evaporate leaving little or no residue. It should be remembered that high flash

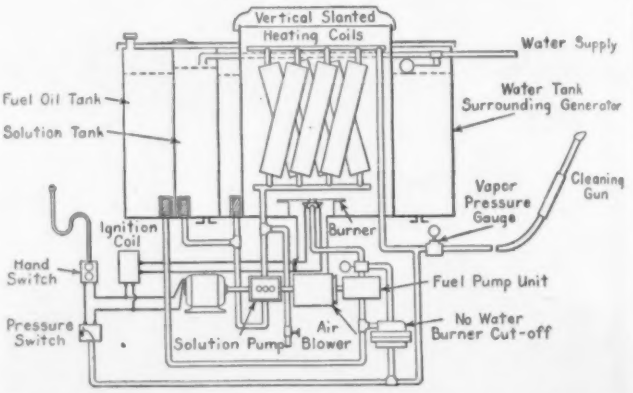


Fig. 4—Typical arrangement of a steam "Jenny" that is used to clean surfaces with hot water under pressure

Fig. 3—Cleaning slotted rotor and commutator of small motor by vapor degreasing method—An electrical emersion heater raises the temperature of the cleaning solvent, trichlorethylene, to the vaporization point only—Cleaning action results from condensing of hot solvent vapors which washes off dirt and grease

point solvents minimize the fire hazard, but they are inflammable. The necessary precautions and facilities should be provided for storing flammable liquids. Usually, insurance regulations provide adequate instructions for storage of solvents.

Petroleum solvents are the least toxic but ample ventilation should be furnished, as should the necessary fire precautions. Carbon tetrachloride is non-inflammable, but extremely toxic, and of very high solvency power. This should be used only when a very severe dirt condition is encountered, and then only with special health precautions. In some cases, carbon tetrachloride is mixed with the petroleum solvents to increase their cleaning power, and decrease the fire hazard. A mixture of 50 per cent carbon tetrachloride and 50 per cent mineral spirits is non-inflammable, but the vapors mixed with the right proportions of air are explosive. In no case should alcohol, benzol, or toluol be used. They are severe, will dissolve or soften the varnish present, are extremely toxic, and are fire hazards. Petroleum distillates of low solvency power will not attack the baked varnish films present but will dissolve oil, grease and loosen dirt. Some air drying varnish films will be softened by petroleum solvents.

Vapor Degreasing Method

For some years the metal finishing or process shops have utilized vapor degreasing tanks for cleaning surfaces prior to further handling or finishing with enamel or paint. This method utilizes the principle of condensing hot solvent vapors on the metal to be cleaned, which washes off the grease and dirt, through a continuous condensing process as shown in Fig. 3. The washing

solvent is always clean, since it condenses on the surface from a vapor. Solvents used are high boiling, toxic, non-inflammable, chlorinated compounds called trichlorethylene and perchlorethylene. Sold under various trade names, these compounds are brothers to carbon tetrachloride, and are known to the chemist as unsaturated compounds. The degree of unsaturation or double bond indicates chemical activity, the chlorine atom gives high solvency to the molecule, as well as non-inflammability. This combination gives a material which attacks or dissolves greases, oil, dirt, enamels and varnish films, and many organic chemicals. However, these solvents have no dissolving effect on shellac and some organic enamel finishes. Trichlorethylene boils at 87 deg. C. (188 deg. F.), while perchlorethylene boils at 121 deg. C. (250 deg. F.).

Such principles may be adapted to clean wound cores or other equipment where all the coils are to be removed, or where equipment is to be rewound, vents and metal thoroughly cleaned. The hot vapors condensing on the equipment attack the dirt, grease, and varnish film. The solvent softens and dissolves the varnish around the coils so that stripping is accomplished easily, and laminations are not damaged on coil removal. If slots and laminations are to be further cleaned, the core may be returned after stripping for another cleaning cycle. This method is not to be recommended where only the insulation surface is to be cleaned and the wound core given a coat of varnish and baked. Some use has been made of the

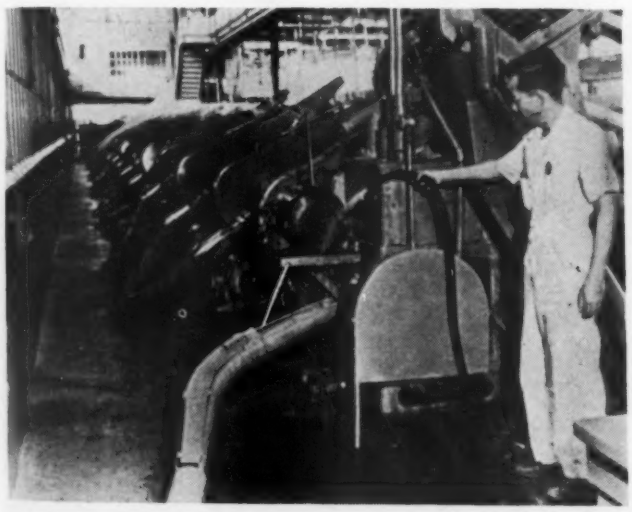


Fig. 5—In some applications, sanitation demands continuous washing of equipment with boiling water and compressed air; though not ordinary motors—These must be of totally enclosed types before it is safe to try to clean them as shown

process for surface cleaning, where the machine has been treated with certain synthetic varnishes, and careful control is exercised in the degreasing process. However, the control must be precise, so that the vapors will not soften the varnish film.

The degreasing process is carried out in a tank, heated by steam or gas, and provided with cooling coils, on the inner walls. There are patented degreasing chambers on the market, which are furnished and installed by companies specializing in this method. In this operation, the cleaning solvent is brought to vaporization or boiling. Then the vapor rises to the condensing coils, located near the top of the chamber. The apparatus to be cleaned is lowered below the vapor line into the vapor, which condenses immediately in a steady stream on the piece. When equipment reaches the temperature of the vapor, condensation stops and the cleaning process is completed.

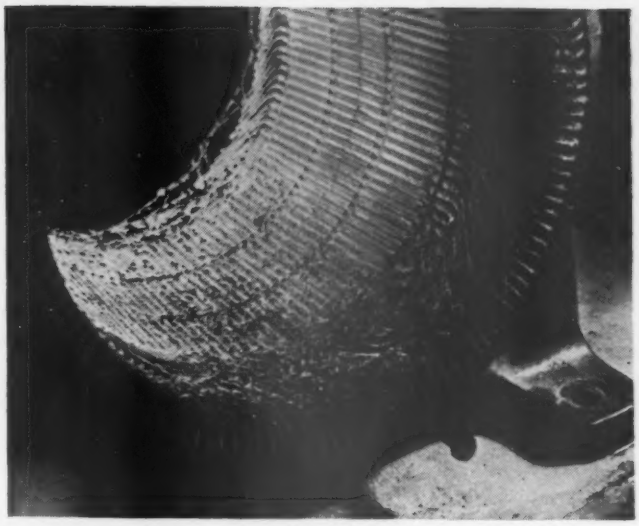


Fig. 6—Dirt accumulation in stator as result of being immersed during a flood—The thickest layers can be removed by immersion in warm running water and then using a brush

Cleaning by Use of Steam "Jenny"

Some success has been achieved in surface cleaning by use of hot water under pressure. Portable steam "jennies" are available with special jet guns and nozzles to eject hot water vapor at 60 to 70 lb. (nozzle pressure). Such a device, outlined in Fig. 4, heats flowing water and ejects it in vapor form through a cleaning gun or nozzle under pressure. This method is efficient particularly for removal of dirt, dust, mud, or chemicals. Attachments are available to feed so-called neutral soaps or solvents into the vapor stream. The soap emulsifies grease or oils present and makes them easily removable. The use of strong alkali soaps should be avoided due to their injury to varnish films and the danger of leaving conducting particles on the insulation. The temperature of the water or soap solution should not be above 90 deg. C. (194 deg. F.), and the pressure at the windings not over 25 lb. per sq. in. Neutral soaps have little effect on the baked varnish film and insulation, however, the operation should be completed by a rinse in warm, clean water. This method does not aid in the removal of coils, but it does clean the surfaces for further repair, or varnish treatment.

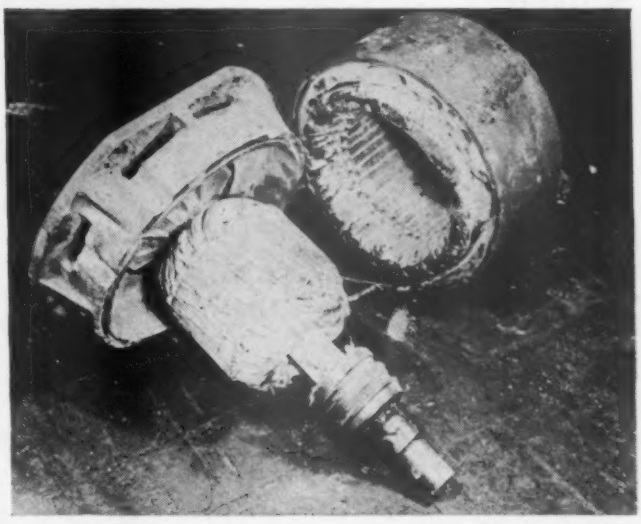


Fig. 7—Contamination of stator and rotor of small motor that had been used in a chemical plant—Running warm water and a brush will quickly remove the heaviest layers of dirt and dust

Fig. 8—Regular wiping off of the motor will do much toward keeping it in first class shape—This should be an essential part of plant housekeeping program

Cleaning by Immersion in Water

Electrical apparatus which has been in flood waters, and is clogged with silt and mud (Fig. 6), or equipment exposed to water soluble chemicals (Fig. 7), probably needs to be cleaned by immersion in water. Some chemicals to which modern electrical machinery is exposed are soluble in water, and become embedded in grease as a hygroscopic slime. These can best be cleaned by immersing the dismantled parts in running water at 52-57 deg. C. (125-135 deg. F.), scrubbing the metal with brushes and wiping the insulation with lintless rags. After water immersion the machines or parts may be given additional cleaning with a steam "jenny."

With any process where water is used on electrical windings care must be taken to dry out the equipment slowly so as not to damage the insulation by formation of steam. There are three methods of drying winding insulation: (1) Internal heat; (2) external heat, and (3) combination of internal and external heat.

Shops where electrical machinery is maintained and repaired should have a forced draft ventilated oven capable of reaching 135 deg C. (275 deg. F.). This could be used for baking of varnish and the drying of machinery after cleaning with solvent or water. When water has been used for cleaning it is preferable to dry the windings in an oven. Regardless of the heating method used, it is recommended usually to limit the first bake to a maximum of 75 deg. C. (167 deg. F.) on the windings, and to raise the temperature slowly to 110 deg. C. (230 deg. F.), maximum for Class A windings and to 130 deg. C. (266 deg. F.), maximum for Class B windings. Frequent insulation resistance readings should be made and curves plotted for future reference, in order to standardize bakes for certain classes and types of machines. The drying time necessary is controlled by the size of the machine, and the heating methods used, as well as the condition of the windings.

Cleaning Cores

Cores can be further cleaned after the coils have been removed by use of a blast of fine sand, applied under pressure. Slots can be cleaned in this manner preparatory to rewinding. However, the operation has to be controlled carefully, in order not to burr laminations, or remove steel from the punchings. There is some question as to the effect on core losses, but there are reports that this method is being used on certain types of cores. The cleaning is carried out by a blast of sand directed through a hand gun at 75 to 85 lb. pressure (at the nozzle). Cores to be cleaned are placed on a special revolving platform which contains hoppers for the sand. All sand is screened automatically before re-use. By means of the hand gun the blast in the slots is directed parallel to the length of the core. Such a method thoroughly cleans all recesses.

Conclusions

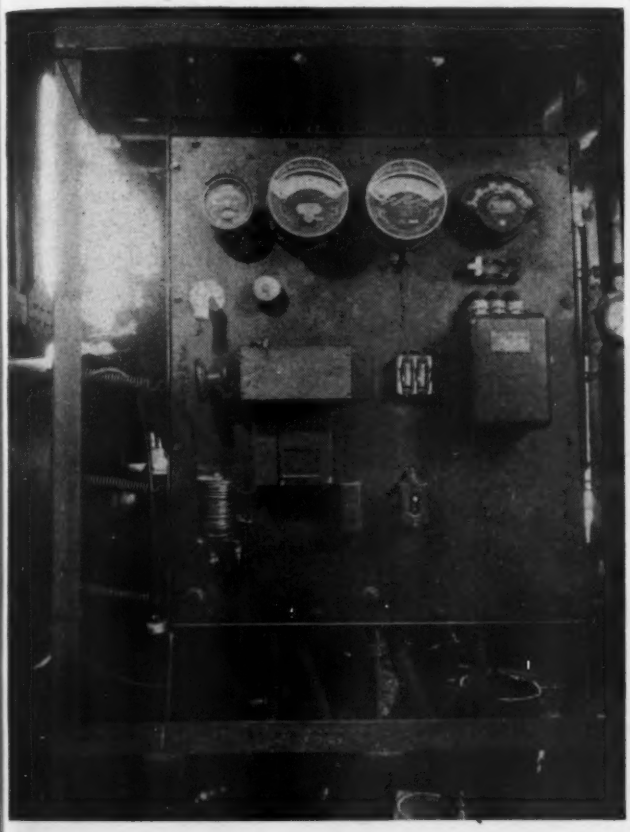
It is not advocated that facilities for such diversity of methods be kept available. However, apparatus to be cleaned should be analyzed thoroughly and the proper methods used to remove the type of contamination. Considerable thought should be given to the type of dirt and foreign matter present. It may be possible that a majority of equipment to be cleaned falls within a certain category, and a suitable method can be installed to speed the process. Proper methods save money, time and labor.

Fig. 9—Measuring insulation resistance of stator windings during baking out—This is essential test procedure at this point as it indicates condition of insulation

Load Testing Traction Motors

Union Pacific insures the performance of traction motors by a load test made before rebuilt motors are replaced on Diesel-electric locomotives

A FEATURE of the very complete Union Pacific electrical repair facilities at Omaha, Neb., is a car equipped for making load tests on Diesel-electric locomotive traction motors. The procedure has repeatedly proved its value by disclosing faults which do not become evident until the motor is loaded and hot and which if not discovered would have caused motor failures on the road. A characteristic fault of this kind is the failure of insulation between coils. Improper banding, soldering, commutator bearing, shaft alignment and gear conditions may also be disclosed. The motors are normally tested with their own support bearings, pinions and gears. They are run at full load for four hours at a speed corresponding to 45 m.p.h. after which the speed is increased to 90 m.p.h. at which speed the motor is run at light load for half an hour.



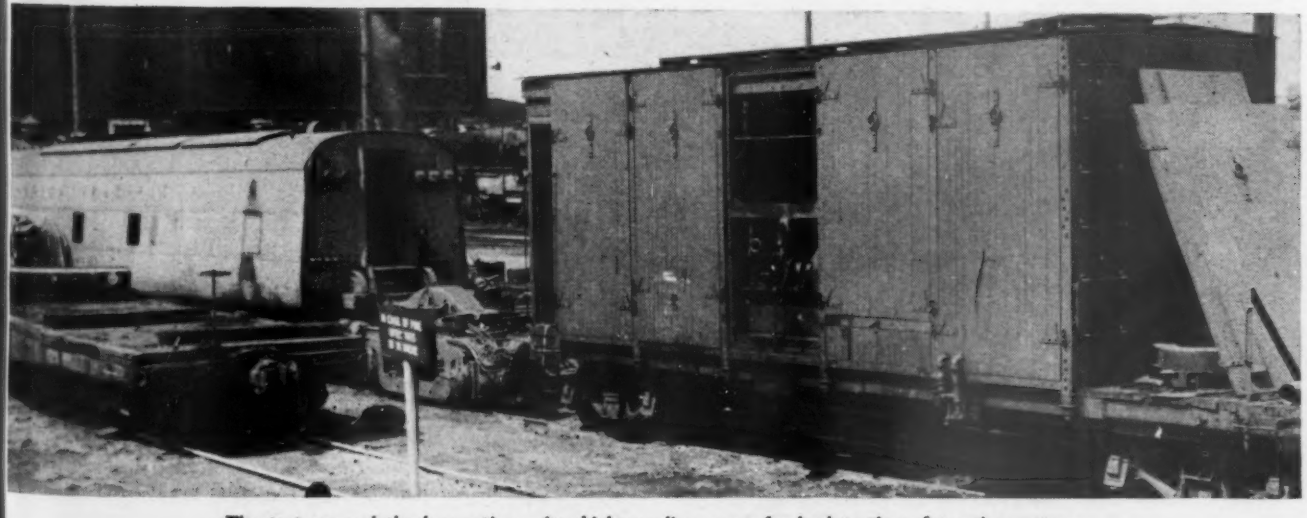
The control board in the test car is supported on springs and is fitted with a voltmeter, an ammeter, a speed regulator, a ground relay and contactors

Under load test the temperature of the commutator is allowed to rise to 240 deg. F. and exhaust air from the fields to reach 180 to 190 deg. F. The temperature of the commutator is measured with a hand pyrometer and cooling air temperature with a recording thermometer.

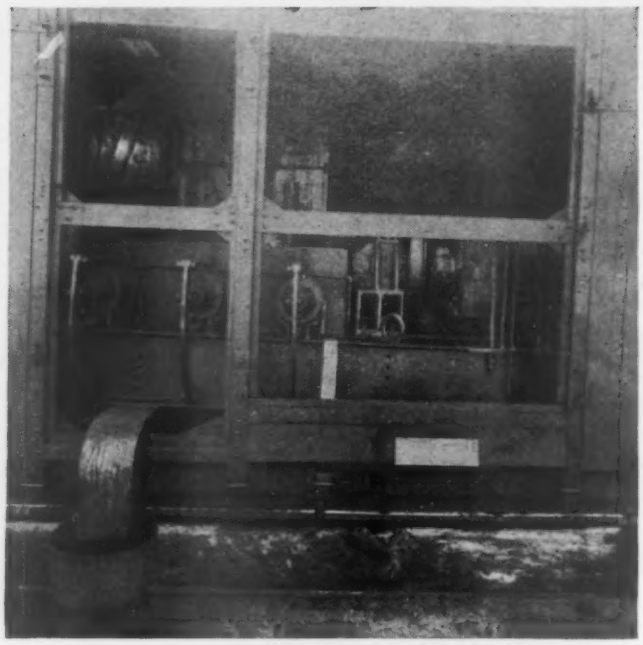
All motors are rewound with hot-pressed, slot-size coils and all rewound motors are load tested. Gears and pinions are matched; the same gear and pinion being kept together when a motor is overhauled.

Test Equipment

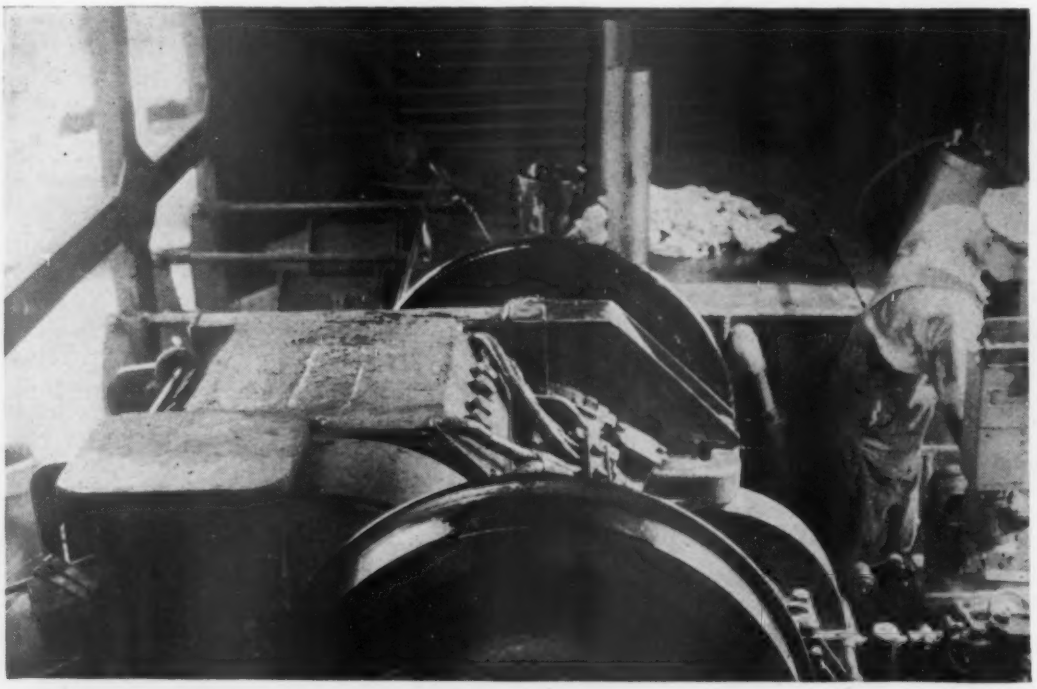
The apparatus used for load testing is housed in a box car which at present receives the necessary power from a retired Diesel-electric locomotive unit having a 1,200-hp. engine and generator. The test stand in the car consists of a mount for the motor which allows the motor gear to mesh with a bull gear which is twice the size of the motor gear. The large gear is on a shaft on which there are also six flanged car wheels fitted with clasp brakes. The wheels and brakes are in a steel tank. During a test,



The test car and the locomotive unit which supplies power for load testing of traction motors



One side of the test car showing the cylinders for operating the clasp brakes—The outlet for the cooling water appears in the foreground



Interior of the test car showing the motor under test in foreground and the metal box containing the six flanged car wheels with their clasp brakes

cooling water flows over the wheels. The water is not recirculated, fresh water at a constant temperature being applied and allowed to drain off to a drainage sewer.

The brakes are applied through a special brake rigging, shown in the illustrations, by a hand-operated air valve. The hand operation may be replaced by an automotive governor.

Ventilating air is supplied by a motor-driven blower which furnishes the same rate of air flow used on the locomotive.

The control board is fitted with a voltmeter, an ammeter, a speed recorder, a ground relay and contactors. The panel is suspended on springs to protect the instruments from vibration.

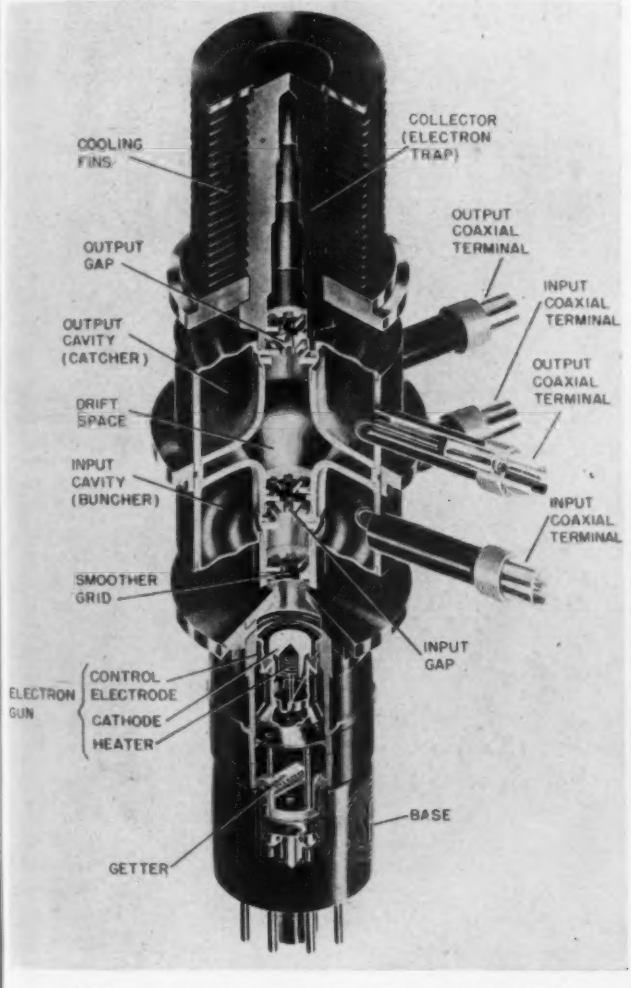
Speed is controlled entirely by braking, operating voltage being held on the motor throughout the test period. A pump-back method of testing was considered but not used, as it would involve reduced voltage and would not so closely simulate road operating conditions. Plans have been made for testing two motors simultaneously, using power from a Diesel engine and generator which go through the shop at the same time the motors are overhauled.

2,660 Megacycles

The Chicago, Rock Island & Pacific has announced that, in cooperation with the Sperry Gyroscope Company, an installation of radio telephone train communication is to be made on 160 miles of double track between Chicago and Rock Island, Ill., using ultra-high frequency waves (2,660 megacycles). The equipment will include Klystron tubes manufactured by the Sperry Gyroscope Company for military and naval radar operations, hitherto a war secret. In contrast with the conventional antennae, an assembly of platters or discs is mounted on a short hollow tubing only a few inches tall, this being an important factor in railroad applications where the clearance on cars and locomotives is limited.

The Rock Island has a license from the Federal Communications Commission to make tests in this ultra-high frequency range at 2,660 megacycles. The equipment, which is crystal-controlled, is operating with a power of 10 watts with a frequency modulation signal 150 kilocycles wide. The 60 channels assigned by the Federal Communications Commission to the railroads for head-end to rear train service are located in the 152-162 megacycle band, which is far below the 2,660 megacycles being tested on the Rock Island. Successful operations in ultra-high frequency on the Rock Island are said to open up, for possible use, a portion of the radio spectrum in which there are an enormous number of unused channels. The Rock Island has been assured that a permanent operating license at 2,660 megacycles will be granted as soon as tests have demonstrated the advantages of using ultra-high frequency. For some time, this type of equipment has been in regular service on one through freight train

Two types of ultra-high frequency antennae are inspected by J. D. Farrington (center), chief executive officer, Rock Island; Ernest Dahl (left), electronics engineer, Rock Island, and Dr. H. H. Willis, vice-president, Sperry Gyroscope Company



A Klystron tube cut away to show its internal construction

operating daily between Rock Island and Kansas City. The advantages claimed are that the ultra-high frequency is not subject to fade-out or blind spots under any adverse conditions such as gorges, tunnels or steel bridges.

On the installation to be made between Chicago and Rock Island, the Sperry Gyroscope Company is to furnish all of the equipment required except for power supply apparatus. Locomotives and cabooses assigned for through freight trains are to be equipped first, and the project will then be extended as fast as practicable to other trains, as well as to certain wayside stations. The first locomotive and cabooses to be equipped with the latest types of the radio apparatus are expected to be ready for service in November.

The Klystron Tube

When the Sperry Gyroscope Company first developed its velocity-modulated, ultra-high frequency tube, it registered the word 'Klystron" as the name of the new device. This name—from a Greek word denoting the breaking of waves on a beach and coined by scientists of Stanford University—is an apt description of the bunching of electrons between spaced grids within the tube. The Klystron produces a pencil of energy beamed like light, reflectors being used for this purpose.

The Klystron converts direct-current energy into radio frequency energy by modulating the velocity of an electron beam between spaced grids.

The Rock Island installations will be under the direction of C. O. Ellis, superintendent of communications; E. A. Dahl, electronic engineer, and A. E. Ganzert, electrical engineer.

Control Circuit Test Panel

The test panel shown in Fig. 1, conceived in the shops of the Union Pacific at Omaha, Neb., makes the checking of Diesel-electric locomotive control circuits easy and certain. At the top of the panel are a number of 64-volt lamps arranged in four rows of seven lamps each. Over each lamp is a letter or code marking corresponding to one of the control-circuits in a locomotive. From the test panel are run two cables each terminated in a 16-contact

Fig. 1—Panel for testing the proper functioning of control devices and the continuity of control circuits in A units of Diesel-electric locomotives

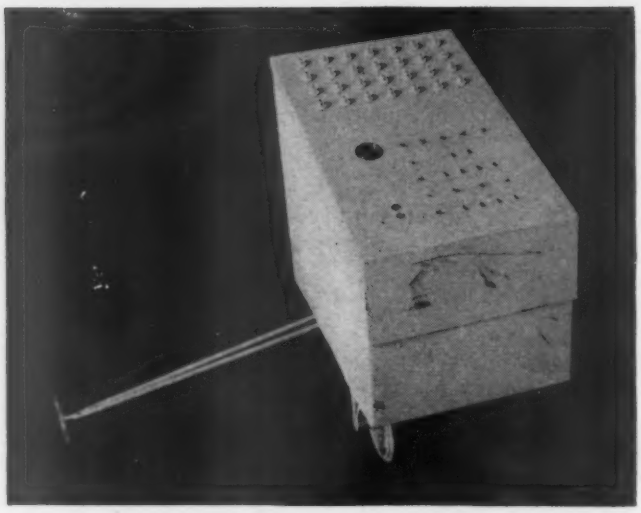


Fig. 2—Panel for testing control circuits of Diesel B locomotive units

multiple plug identical with those normally used between locomotive units. Each lamp on the panel is connected to the proper contact of one of the plugs so that it will light when that particular circuit is operated from the control position which is at the front of the locomotive unit.

There is also a telephone on the test panel which is connected by a separate pair of leads with another in the locomotive cab. When the circuits are being tested, a man in the cab operates the various switches and control devices, each operation applying or disconnecting the 64-volt battery power to one or more of the control circuits. The test panel is normally placed on the ground near the rear of the locomotive unit. By means of the telephone, the man in the cab advises the man at the board what connections have been made and the man at the panel checks the operation by watching the lamps and advises the man in the cab. Since the plugs used are master plugs, the operators cannot make a mistake by connecting a test lamp to the wrong circuit. Indications on the board are *B* plus for positive battery, *PC* for positive control circuit, *OSL* for oil signal alarm, *TSL* for hot engine alarm, *A, B, C,* and *D* for throttle sequence, *ABP* for brake application, *FOR* and *REV* for reverser operation, etc.

The test panel shown in Fig. 2 is being developed for the testing of control circuits in B locomotive units. The toggle switches on the lower half of the panel energize the B control circuits in the same manner as the control devices on an A unit and 64-volt power is supplied by a small motor-generator set in the test panel. The sockets at the top of the panel will contain the circuit indicating test lamps.

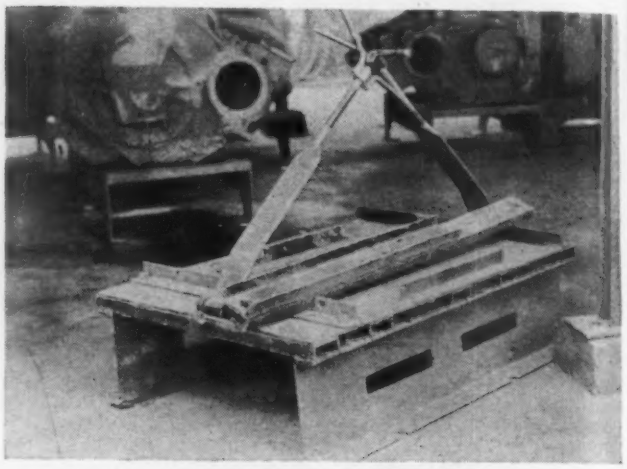
Adjustable Motor Skid

For handling Diesel-electric traction motors in its repair shop at Silvis, Ill., and for shipping of motors to and from other locations, the Rock Island is now using an adjustable motor skid which can be used with motors of various sizes and handled easily with different types of lift trucks.

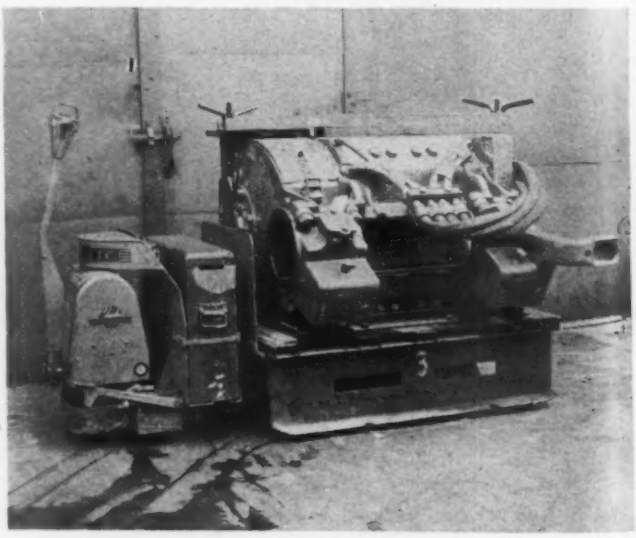
The skid, which is 14 in. high, 35 in. wide and 52 in. long, consists of a bed plate on two 12-in. channels. The motor is placed between angle irons which are secured to the deck or bed plate of the skid. Two of the angles are welded to the deck and the other two are secured with cap screws. Holes for the cap screws are drilled in the angle irons and in the deck, there being one set of holes in the deck for each size motor. Nuts, aligned with the holes, are tack-welded to the under side of the deck and the holding cap screws are threaded into these nuts.

The motor is held down by two straps hinged to each side of the skid and a cross bar consisting of two channels welded back to back. Each hinged strap is terminated in a threaded rod fitted with a wing nut or pair of handles 8 in. long which eliminate the need of a wrench. When the motor is placed on the skid, the hinged straps are lifted to a vertical position on each side of the motor, their ends run through holes in the cross bar and the wing nuts applied and tightened.

The skids with the motors are handled in the electric shop with heavy-duty Automatic Transporters made by the Automatic Transportation Company, Chicago, the transporter being run under the skid from one end as illustrated. In other locations it is necessary to move them with fork trucks. This is provided for by slots cut in the sides of the 12-in. skid channels.



Various size motors may be secured firmly to the skid and it may be handled from the end by a lift truck or transporter and from the side by a fork truck



The skid with a motor in place on an Automatic transporter

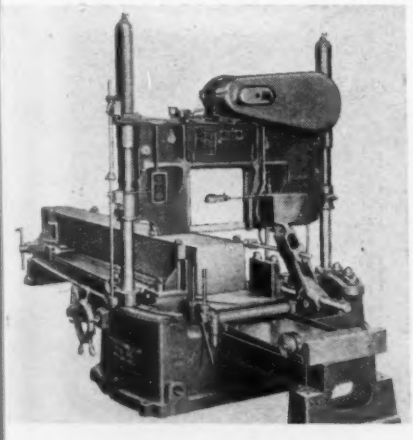
NEW DEVICES

Shop Tools and Equipment—Materials—Locomotive and Car Specialties

Roll Stroke Hack-Sawing Machine

The No. 18 Marvel universal hack saw, which has a minimum work-piece capacity of 18 in. by 18 in., employs an entirely new principle of blade reciprocation in its "Roll-Stroke" movement. This machine, manufactured by the Armstrong-Blum Manufacturing Company, Chicago 39, is heavily built and reinforced to meet heavy work demands in locomotive shops, forge shops and steel mills. Heavy work is easily and safely moved in and out of the machine on a work track and dolly. Cut off pieces are safely supported on a discharge track and roller. All moving parts are fully enclosed as a safety measure and to prevent the entrance of abrasive dust and dirt.

The roll stroke movement employed puts only a relatively short length of blade in contact with the work at any one time. As a result, shorter chips are formed which do not clog the tooth gullet, chips are progressively eliminated from under the blade and required blade pressure is considerably reduced. Anti-friction bearings are used on moving parts and the blade



Heavy duty metal cutting machine

frame, of welded-steel construction, is carried on four roller bearings.

The hydraulic system used on the machine operates at low pressure. There is a range of blade speeds from 65 to 165 strokes per minute. The hydraulic pump is required to operate only during the intervals when the blade is being raised. This controlled feed permits cutting of light sections or pieces of full machine capacity rapidly. Miters can be cut by swiveling the entire main housing to any desired angle up to 45 deg. Protractor bands at each end of the table bed indicate the angularity of the cut which will be made. Safety stops are provided and, if blade tension is not sufficient or if a blade breaks or if feed pressure is excessive, the machine stops automatically and cannot be operated until the condition is corrected.

A one-shot oiling system is used to lubricate the entire machine. Blade coolant is delivered from four adjustable jets, mounted in the housing, which remain in the same position relative to the blade throughout the full vertical traverse.

Flue Welder

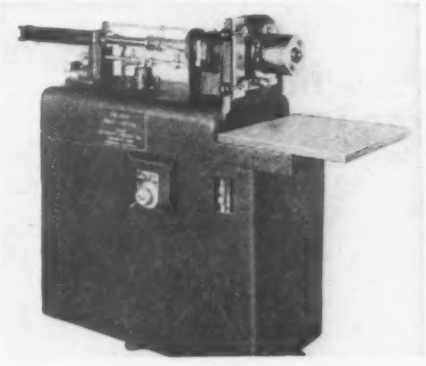
A flue welder with a productive capacity of from 30 superheater tubes per hour to 100 small tubes per hour and which may be provided with several sets of dies to take care of various size flues has been announced by the Thomson-Gibb Electric Welding Company, Lynn, Mass.

Push-up pressure is applied hydraulically with a long lever at the operator's right hand to provide a convenient control of platen travel. A push button operating a magnetic contractor current control is mounted on the pressure-control level. Air-operated clamps are controlled by levers at hand level in front of the dies. The water-cooled dies are vertically adjustable by hand wheels. A five-point heat regulator provides the one best welding heat for the power conditions in the individual shop.

The 150-kva. transformer is offset in the frame so that flash never touches the transformer core or coils. The slide bearings are set out at the ends well away from the line of the flash and the clamp operating mechanisms are shielded by flash-proof hoods.

Piston-Ring Lapper

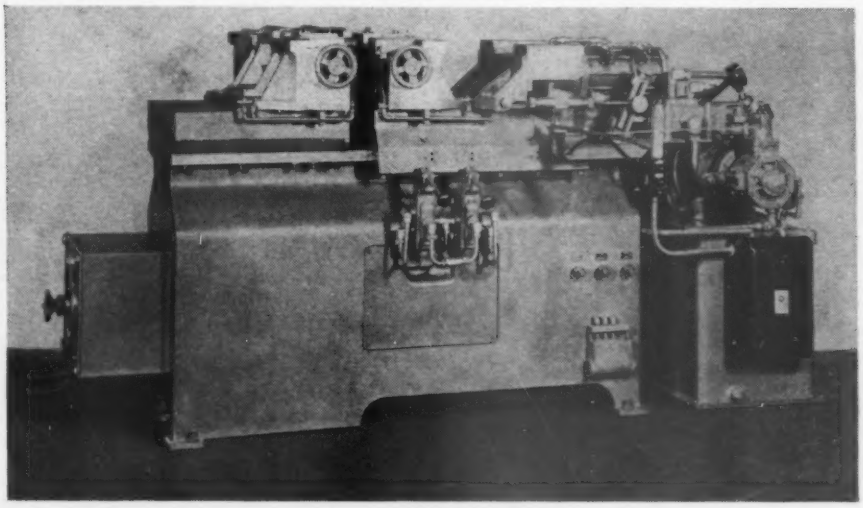
A piston ring lapper suggested for proper fitting of rings and cylinders in such equipment as air compressors, Diesel and gas



Lapping machine for fitting rings

engines, pumps, hydraulic cylinders, piston and triple valves, sealing rings, plungers and cylinders of fuel control valves, spray valves, fuel injectors and many other applications where perfect fit and minimum leakage are required, is being manufactured by the C. Allen Fulmer Company, 1237 First National Bank Building, Cincinnati 2, Ohio.

This machine has been engineered to give a half revolution of the spindle on a full outstroke, with no rotation on the return stroke. At each reciprocating cycle, the spindle "hunts" so that there is no possibility of the abrasive traveling over the same path during the next stroke of the lapping operation. The spindle operates



High-production flue welder

in a bath of oil and carries a wiper seal to protect it against dirt and grit. Stroke-setting stops can be set to give working strokes from 2 to 12 in. and a reset counter tells the operator the number of strokes for each operation.

The machine is equipped with a Vickers hydraulic pump and valves, with the pump driven by a 2-hp. motor. The tank, motor and valves are incorporated in the base of the machine, with ample room for getting to any part of the equipment as needed. Adaptor plates can be supplied to hold any size cylinder required, and the cylinders are locked in position with quick-action clamps. Steel lapping heads can also be supplied, for any engine, which do not require the rings to be opened up in putting them on or taking them off the head.

Plate Duplicator For Irregular Shapes

The Thomas Machine Manufacturing Company, Pittsburgh 23, Pa., announces the development of a plate duplicator built to overcome such wasteful practices as hand marking, hand positioning, and the use of two or three machines where coping, notching or different size holes are required in the working of a small number of shapes.

The duplicator comprises a deep throat punch with a solenoid control clutch, a template pin cluster connected by shafts to a punching tool head, and an all-steel table carrying rollers to support plates to be punched. Roller-bearing track wheels support the table, which is moved by pinions engaging track racks and controlled by a handwheel.

In operating, the plate and template are clamped to a heavy channel-section carriage. Using the handwheels, the operator moves the templet under the desired locating pin. By a foot-switch operating a solenoid, he forces the pointed locating pin down through the hole in the templet. This pulls the table into position under the punch, also operating the gag on the punching tool selected and engaging the punch by means of solenoid, and the punching is made. Holes can be punched diagonally or in any direction. As many as 11 tools including round, square and slotting tools, may be set in the punch. When shifting from one tool to another, a lever is thrown to select the tool is wanted.

An oscillating stripper is provided to hold light work where distribution might occur. Rollers on each side of the punch are spring mounted so the plate rides free of the dies. The duplicator has an accuracy of between $\frac{1}{64}$ in. and $\frac{1}{32}$ in. Holes as large as 6 in. in diameter and of any shape may be punched.

Plate duplicator intended especially for use on irregular shapes and short runs

Diamond Grinding Wheels

J. K. Smit & Sons, Incorporated, 157 Chambers street, New York, has developed two diamond wheels of unusual shapes, one for a special form grinding job and the other for sharpening all types of multi-bladed cutters. The unusual shapes of these two

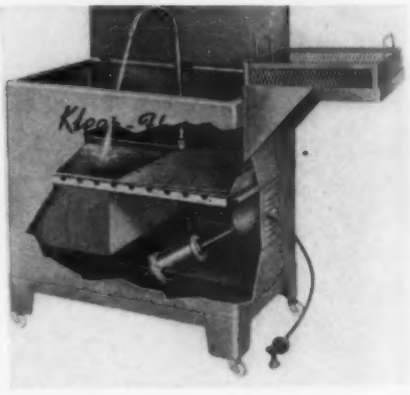
Diamond grinding wheels of special form

wheels provide maximum clearance with a minimum of contact area between wheel and work. With the diamond section mounted on the periphery of the core, only the inside of the core requires dressing as the diamond section wears away. The core may be easily cut away with a dressing stick.

Type 660B, the shallow dish wheel, is capable of grinding accurately and holding form in the sharpest corners. Rigidity provided by a sturdily-built bakelite body allows for the performance of delicate operations even at high speeds. It is available in a 6 in. diameter. Type D11B, the flaring cup wheel, is designed for economical general tool and cutter grinding. Maximum cutting efficiency is due, in part, to the rigidity of the solid body construction. Various resinoid bonds are supplied to meet the requirements of every type of grinding operation, BD bond for fine carbide-tipped reamer flute grinding, BC bond for intermediate size carbide tipped cutters, and BV bond for larger cutters and heavy stock removal. It is manufactured in 3¼ and 5 in. diameters.

Metal Parts Cleaning Machine

A metal parts cleaning machine which can also be used for the cleaning of small electric motors or other small assemblies is manufactured and distributed by the Practical Products Company, Minneapolis 8, Minn., as its Klear-Flo 30 model. The unit has a 20-gal. capacity tank from which the cleaning compound employed is circulated by means of an electrically driven pump through a semi-rigid metal hose which can be adjusted to direct the flow of cleaning fluid in any desired direction. The circulating pump is enclosed in a cast-iron



Small metal parts cleaning unit

housing and operates to eject heavy dirt and sludge from cleaning fluids before they enter the filter. Replaceable filter elements are readily changed. The electric motor furnished is for 110-volt 60-cycle current and is designed to be sparkless. It is fan cooled. Other motor types are also available.

The cabinet of the unit is of all-steel, electrically-welded, gusseted construction and is made of 20-gauge steel with an enamel finish. The cover is hinged and is designed to protect against fire. The machine occupies a floor space of 24 in. by 36 in. and is mounted on casters so that it can be moved readily about a shop.

Magnetic Inspection Unit

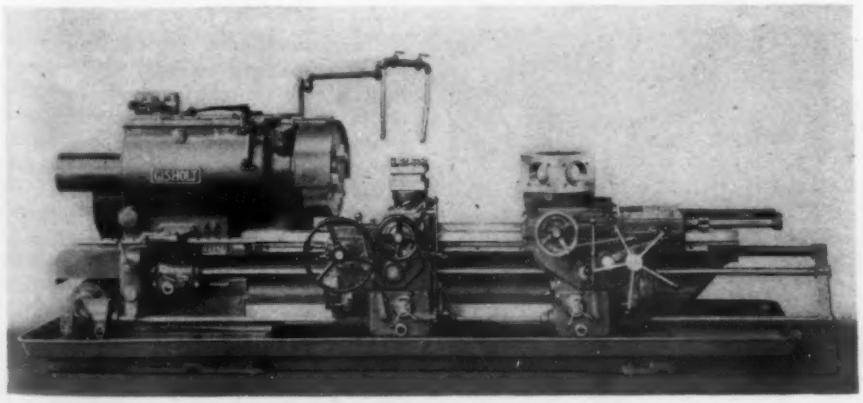
A unit for magnetic particle inspection, known as the KH-2 unit, has been introduced by Magnaflux Corporation, Chicago. It is particularly well-suited for the inspection of welds, castings, large forgings, and machinery parts. It permits detection of deep sub-surface discontinuities and enables an inspector to distinguish between laminations and segregations in rolled plate. Welds designed with open roots can be inspected without interference of non-relevant indications. It may also be used to locate shrinkage cracks, hot tears, blow holes, porosity, etc., in castings; thermal cracks, lack of penetration and fusion, slag inclusions, and other discontinuities in welds; laps, bursts, cold shuts, etc., in forgings; and fatigue cracks in machinery parts.

A mobile magnetic inspection unit for general shop use

Turret Lathe

The Gisholt Machine Company, Madison, Wis., has developed a high-production saddle-type turret lathe which is being used for machining operations on such replacement parts as locomotive rod bushings of various sizes, employing a cross-feeding turret feature with simple tooling; locomotive front and main crank pins and cross-head wrist pins of the larger sizes, machined with single-cutter turners and other suitable simple tools; taper bolts, and other locomotive parts.

This model known as the 3L, augments, through its larger capacity and specifications, the utility afforded by the somewhat smaller saddle-type machines and ram-type turret lathes made by the company. It has 4½-in. or 6-in. round bar capacity, 5 1/16-in. or 6¼-in. spindle bore, and 28½-in. swing. The 3L turret lathe is a much heavier machine than the model which preceded it, and is correspondingly rigid and sturdy. It embodies all the latest Gisholt design features intended to contribute to strength, versatility, operational ease, and long life.



Saddle-type turret lathe used in machining locomotive parts

Hydraulic Crank-Pin Grinder

Crankshafts for Diesel engines which have a weight of up to 5,000 lb. and a maximum length of not over 230 in. can be ground on the 40-in. by 216-in. Type-B hydraulic crank-pin grinder made by the Landis Tool Company, Waynesboro, Pa. This machine incorporates most of the features of the Landis Type-B plain grinder with special changes made to adapt it for crank-shaft grinding.

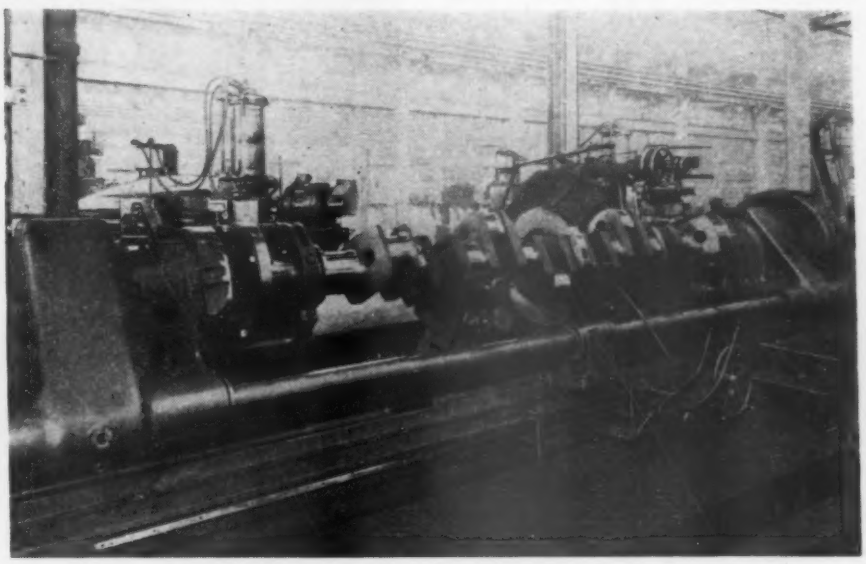
The work heads and drive were designed especially for the handling of exceedingly large crankshafts. Of outstanding importance is the dual work-drive arrangement which eliminates or minimizes objectionable torsional deflection in the crankshaft. Power is transmitted from each work-drive motor through a combination multiple-vee belt and silent-chain reduction unit to a drive shaft extending along the entire front of the machine. The speed of the work-drive motors is synchronized electrically. A jogging handwheel on the drive shaft in front of each head enables the operator to rotate the work on the grinder readily in order to engage the fixture-aligning latches.

The work heads may be moved longitudinally on the work table, thus permitting them to accommodate shafts of varying lengths. Both work-head spindles are extra long and on the outer end of each a balancing weight may be adjusted on a slide as required. Work-spindle bearings are automatically flood-lubricated and have a bull's-eye gauge at the front of each head for the checking of the oil supply.

Throw blocks for crankshafts having varying end main bearing diameters are interchangeable. The top half is of the floating type so it can be used for final clamping purposes. Fixture-aligning latches are provided to hold the two work fixtures in alignment during loading and unloading. End-wise locating is provided for in accordance with the characteristics of the shaft being ground. It is usually against a stop on the indexing plate or against the side of the clamping block. Radial locating may be by means of a revolving indexing plate or a fixed stop plate.

A conventional work rest is used to support the shaft at each of its ends and a special rest is employed at the center main bearing. This latter rest is provided with an eccentric ring which may be slipped over the crankshaft from the end. There is a work-clamping arrangement in it. Inasmuch as the ring is eccentric in shape, it may be used for a variety of throws and interchangeable clamping blocks permit it to handle a variety of center main-bearing diameters. The ring revolves with the work and is supported by water-cooled lignum-vitae bearings held in a semicircular base.

A shoulder-grinding attachment is sup-



Diesel engine crankshaft grinder

plied to grind crankshaft cheeks. It is particularly rugged and is not intended merely for slight truing up of the cheeks but for the rapid removal of as much metal as may be required. Control is by means of a hand-wheel to the right of the regular feed-up hand-wheel. Grinding may be done from either left to right or right to left; the amount of movement is ¼ in.

An electrical control desk, usually located facing the front center of the machine, gives centralized electrical control. There are push buttons for starting and stopping the various electric motors, and field rheostats for adjusting the speed of the adjustable-speed work-drive and traverse motors. Two ammeters enable the operator to determine accurately and quickly whether the crankshaft is perfectly balanced before he starts to grind. To simplify the operation of the machine further, all electric motors may be started and stopped from a second push button grouping at the front of the wheel base.

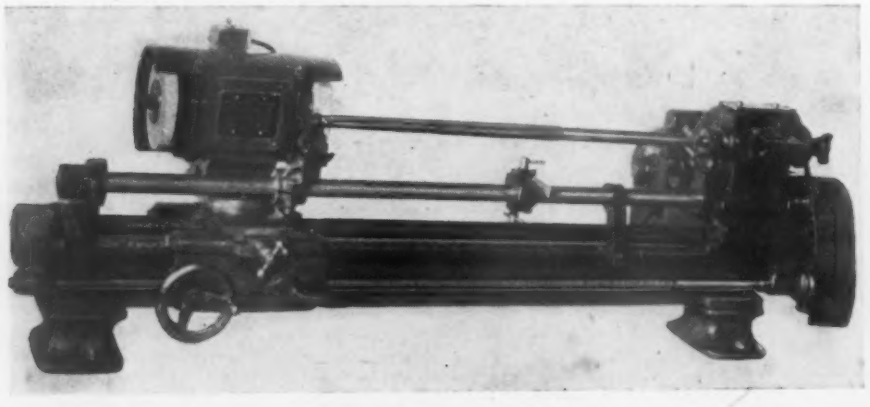
Tap Grinder

A tap grinder for sharpening staybolt taps, long taper reamers and other tools requiring relief grinding over long taper surfaces is announced by Edward Blake Company, 634 Commonwealth Avenue, Newton Centre 59, Mass. This machine is designated as Model No. 4 and is especially designed so that the side of a small wheel is fed along the taper of long taps, instead of having a wide wheel to cover the complete taper in one pass.

The work head is mounted on a lathe bed and the wheel head is mounted on the lathe carriage cross slide. The controls on the cross slide give longitudinal and cross feed motions to the wheel head. Staybolt taps and long taper reamers are held on ball centers. The tailstock center can be moved off center any desired amount so that the flutes remain parallel to the grinding wheel. Any desired relief can be obtained by a simple setting, and any right- or left-hand tap, up to 43 in. long with 2, 3, 4, 5, 6, 8 or 10 flutes can be sharpened.

Rotation of the work is automatic. This is accomplished with a separate motor mounted behind the work head which revolves the work through a train of gears. The gears may be disengaged easily for hand operation. Power longitudinal feed for the wheel head is obtained by engaging the lead screw on the carriage. A locating device sets the tap flutes in the proper grinding position. A wheel truing device is also provided. It may be positioned anywhere along the pivot bar, and, after being locked, the wheel is fed past the diamond for truing.

The No. 4 machine is regularly supplied with two 110-volt, 60-cycle, single-phase, a. c. motors and two 80-grit, ¾-in. face, 6-in. diameter grinding wheels.



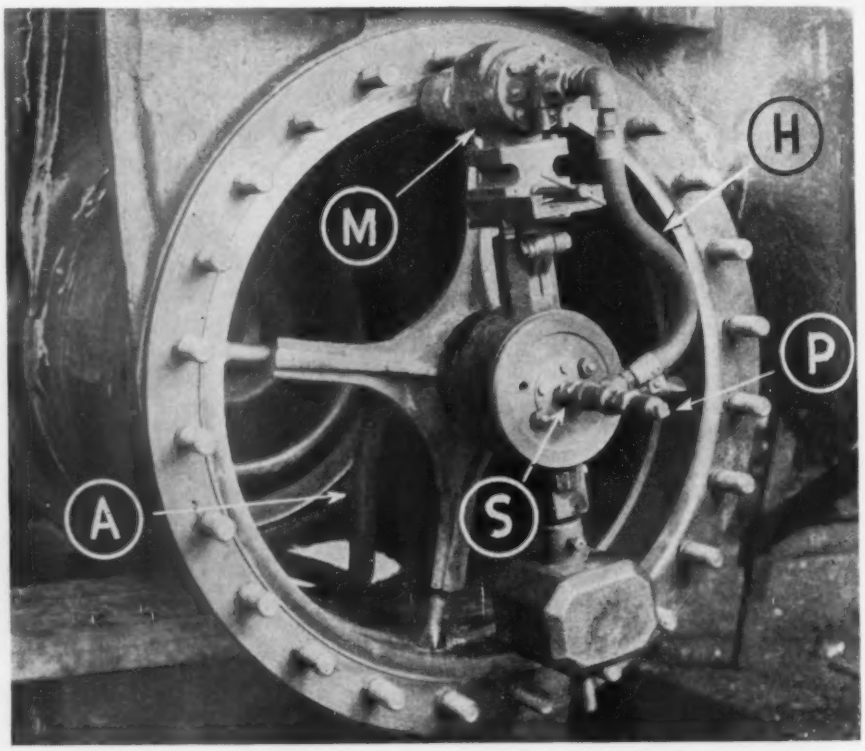
Grinder for sharpening long taps

Cylinder-Joint Grinder Improved

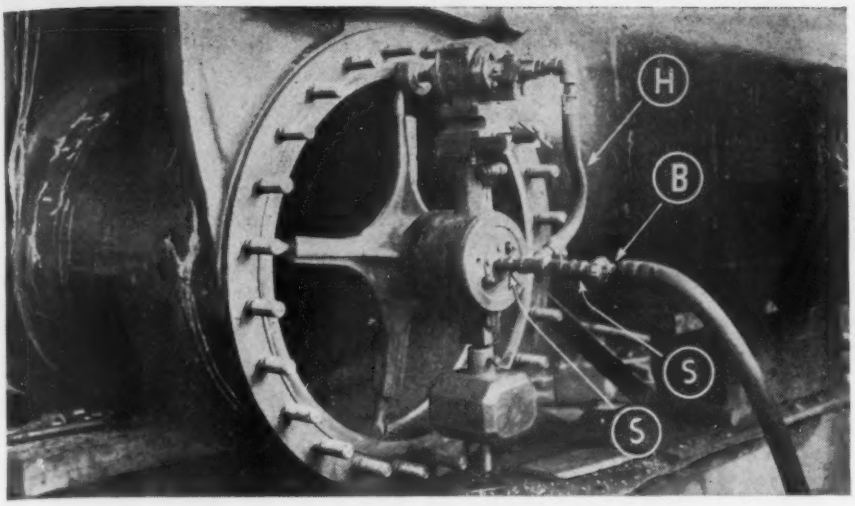
The portable, rotary, surface-grinding machine, developed by the R. J. McQuade Company, Chicago, for refinishing steam-locomotive cylinder joints, as described in the May, 1942, *Railway Mechanical Engineer*, has recently been improved by substituting a more powerful air-motor drive for the ½-hp. electric-motor drive formerly used. The new air motor is of the Thor centrifugal type, made by the Independent Pneumatic Tool Company, and delivers 1½ hp. at 6,000 r.p.m., the free speed being 8,000 r.p.m. It is direct-connected to a 2½-in. cup-type grinding wheel which refinishes the joint surface as the rotating arm is slowly revolved by hand around a center post supported by a spider in the end of the cylinder. Infeed of the wheel is provided by means of hand-feed screw.

The greater power of the air-motor drive permits taking heavier grinding cuts without danger of stalling the motor, and grinding time is proportionately reduced. In an actual test, the machine was set up in the counterbore of a 26-in. steel cylinder, with cast-iron bushing, the spider centrally located and the grinding wheel adjusted radially so as to just clear the studs, which need not be removed when using this particular type of machine. The total set-up and adjustment time was 30 minutes and the grinding time necessary to produce a smooth, accurate seat for the full width of the bearing surface was 30 minutes, or a total of 60 minutes. This may be compared with 30 minutes set-up time and about 90 minutes grinding time, or a total of 120 minutes, formerly required with the electric grinder on a cast-iron cylinder of the same size. In this comparison, the air-motor drive is penalized to a certain extent, since the machine was working on a steel cylinder which is tougher material to grind than cast iron.

A simple piping arrangement permits either of two air connections to be made to the cylinder-joint grinder, as now



McQuade cylinder-joint grinder equipped with new Thor 1½-hp. air motor—With piston removed, air connection is made through the back of the cylinder, as shown in this illustration



Air supply to the McQuade cylinder-joint grinder when the piston is not in the cylinder

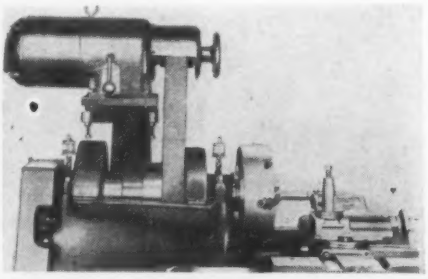
equipped with air-motor drive, dependent upon which is more convenient for the operator. If the piston is out of the cylinder, the shop air hose is inserted in the cylinder from the back, as shown at *A* in one of the views, and coupled to a ⅜-in. pipe connection which passes through the center-post to the front of the machine and thence upward through a ½-in. flexible rubber hose *H* to the air-motor *M*. Outer end *P* of the air line is plugged and a pipe swivel *S* between the ⅜-in. tee and the cover plate permits the tee and air hose to rotate as the machine is used. There is sufficient slack in hose *H* in conjunction with three different motor extensions, supplied with the machine, to permit grinding cylinders from 22 in. to 32 in. in diameter and one special machine has been built for a railroad to grind 39-in. cylinders.

The piping arrangement described leaves the machine operator entirely unhampered by interference with the shop air hose. In case the piston is in the cylinder, the inner end of the air-supply line is simply plugged and the shop air hose connected to the outer end, as shown at *B* in the other view. Two swivels, *SS*, one on either side of the ⅜-in. tee, permit the tee and air-motor hose *H* to rotate without winding up or twisting the shop air hose. Even with this arrangement the shop hose does not interfere in any appreciable way with the operator.

Gearshift Drives For Machine Tools

Gearshift drives made in sizes from ½ hp. to 25 hp. which are available with motors having various speed ratings are manufactured by the Chicago Railroad Supply Company, Chicago 4, for practically all machine tools. These gearshift drives, either with direct motor drive or belt drive, are furnished as standard equipment with four forward speeds. A reversing-drum control can be furnished which will give four reverse speeds also.

When provided with two-speed motors the units have a total of eight forward and eight reverse speeds. Gear shifting is done with a lever conveniently located for the machine operator's use. Direct-connected



Gearshift drive unit applied to an engine lathe

drives are furnished with drip-proof motor frames to prevent damage caused to motors by flying chips or dripping.

Multi-Production Lathe

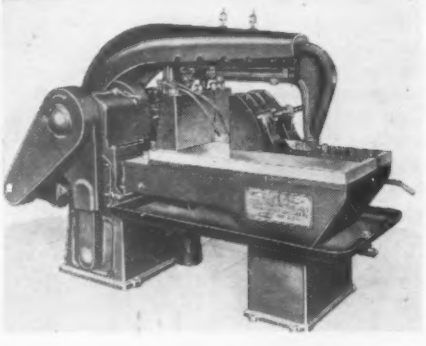
A semi-automatic lathe designed and equipped to machine duplicate shafts, which is intended for railroad shops where shafts are not produced in sufficient quantities to justify the set-up time required by the automatic lathe but are produced in large enough quantities to make the production afforded by the standard engine lathe too costly, is produced by the American Tool Works Company, Cincinnati 2, Ohio. Users report that it pays to set up multi-production lathes for lots containing as few as four pieces.

Multi-production lathes are equipped to use cemented-carbide cutting tools to the limit of their efficiency. They have the power, the range and the duplicating equipment to insure effective use of these high-speed cutting tools. The duplicating equipment provides the further advantage of eliminating time loss required for measuring and calipering and of reducing spoiled work to a minimum.

An advantage in versatility over the automatic lathe is offered by the multi-production lathe. By retaining all of the standard engine-lathe features it provides the same adaptability and range as the standard engine lathe while in addition through its combination of automatic length stops, positive diameter stops, direct measuring cross feed dials with indicating clips, and special multiple tooling, it offers in a very high degree the productive advantages of the automatic lathe.

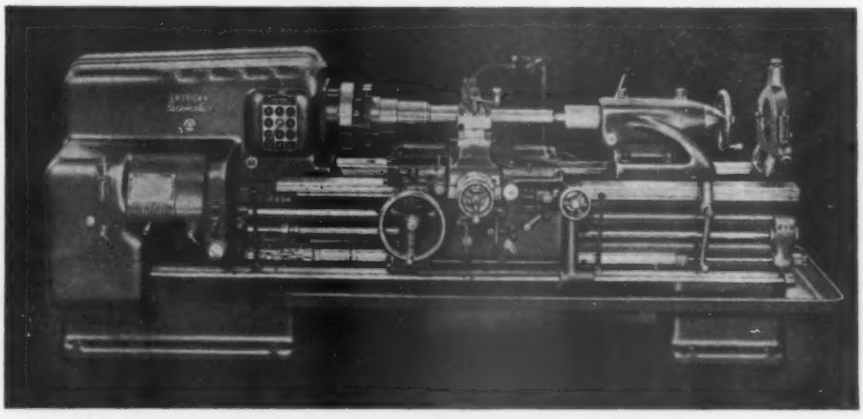
Heavy-Duty Hydraulic Metal-Cutting Machine

The Racine Tool & Machine Company, Racine, Wis., has in its line two heavy-duty metal-cutting machines developed especially for the cutting of solid bars of large



Metal-cutting machine designed for heavy work

dimension stock. They may also be used for the cutting of large tubing, structurals, tough alloys, forgings, castings, die steels



A semi-automatic lathe which produces duplicate pieces

and all classes of non-ferrous metals. The Model 40-C which is illustrated has a capacity of 14 in. by 20 in.; the 41-C has a capacity of 20 in. by 20 in.

A positive progressive feed is provided for cutting tool steel and tough alloys. A flexible feed allows the saw blade to move rapidly in small areas of stock and when cutting through the light-walled section of tubings, structurals and shapes. All feeds are controlled through a graduated feed dial. Constant hydraulic pressure applies the feed and controls other operating functions. A single lever operates the controls.

The machines are driven by a 3-hp. motor through five vee belts and an hydraulic twin-disc clutch connected to a three-speed transmission. Belts and pulleys are fully guarded. The table plates and steel wear plates on the vise jaws are replaceable and a swiveling vise can be furnished if needed.

Plate Shears

Plate shears of all-steel construction are offered by the Cincinnati Shaper Company, Cincinnati, Ohio, for use in shops having sheet or plate cutting work such as is encountered in railroad boiler and car shops. The shears are designed as precision tools and are equipped with single control, back-gauge, adjustable stainless graduated scales in the work table and with front gauges having extension arms. The accuracy of cutting is said to be such that micrometer measurements are needed to detect variations in cut sections.

The shears are furnished with four-edged knives as standard equipment which give four cutting edges on each knife before regrinding is necessary. Hydraulic holddowns are used; these deliver a heavy uniform pressure along the full length of the working table and serve to prevent slippage of work even when there is a variation in plate thickness. The holddowns are a series of independent plungers actuated by oil pressure, spaced from end to end on 12-in. centers. All plungers exert a uniform pressure regardless of the amount of their movement and the pressure developed by a single plunger is sufficient to hold in place any small work which is to be cut under it.

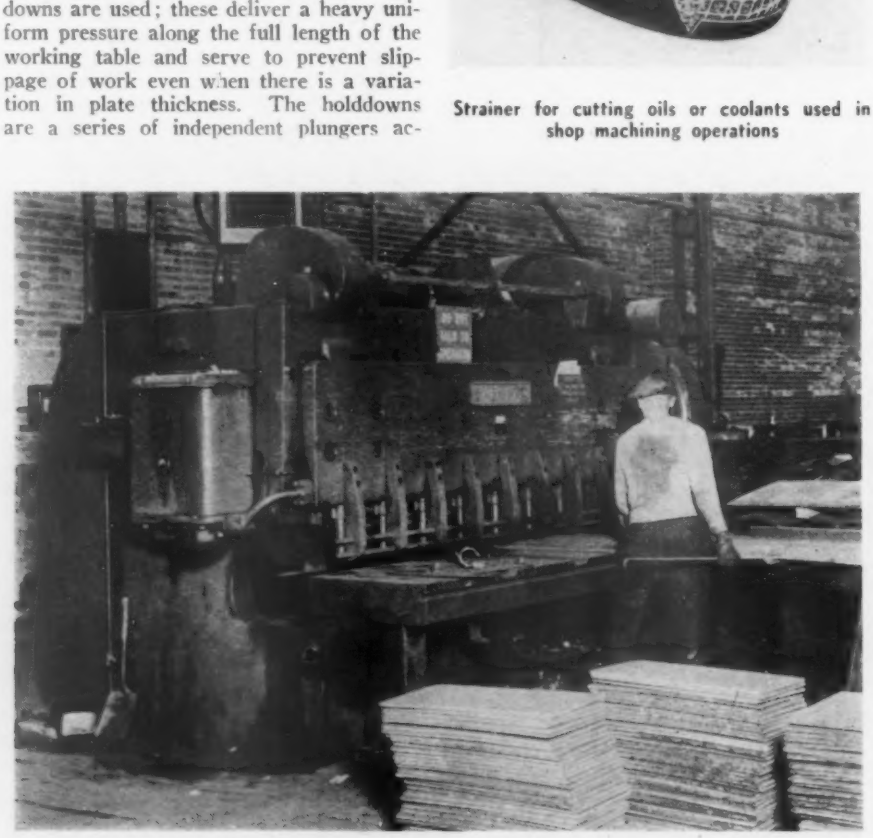
The general design of the machine frame and the operating mechanism and drive is similar to that of the press brakes also manufactured by this company.

Strainer for Machine Tools

A non-clogging industrial strainer for use with turret lathes, screw machines, grinders, and all other machine tools that employ a cutting oil or coolant is manufactured by the Strainer Products Corporation, 75-77 North Willow Street, Montclair, N. J., under the trade name of Strainco-Metex. The units have a long-period capacity for dirt, chips and grit. Strainer refills are easily installed and old ones can be washed and made ready for re-use in a matter of minutes. The efficiency of the strainer prevents metal cuttings and chips from lodging in the pump, and reduces the time required ordinarily for pump cleaning.

The units are supplied in types, sizes, and capacities adapted to every size and type of machine tool. Manufactured of fabric and wire strands knitted into a honeycomb construction, the mesh is designed into non-collapsible strainer units of high capacity and large strainage area.

Strainer for cutting oils or coolants used in shop machining operations



A plate shear being used to cut armor plate

Hard-Facing Welding Rod

The Eutectic Welding Alloys Company, 40 Worth Street, New York 13, has introduced into its line of products a new hard-facing alloy rod which, when applied by either the oxyacetylene or electric-arc welding processes, gives readings on the Rockwell C scale of from 58 to 63. The new alloy is available in two qualities, as EuteChrom 13 for oxyacetylene application, and as EuteChrom 130 which is the same alloy with the addition of special shielding for arc welding with both a.c. and d.c. current. A special flux is used with EuteChrom 13 when applying it on steel and an acetylene excess is required. In applications on cast iron, an oxygen excess is employed. The alloy is said to deposit readily on cast iron and all types of steel. At present the rod is furnished in only ¼-in. and 3/16-in. sizes.

Screw-Type Electrode Holder

A screw-type electrode holder, one-third lighter than its corresponding size clamp-type holder, has been announced by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Exposed metal surfaces of the holder are constructed of spatter-resistant Mallory metal. Simplified design facilitates easy replacement of parts, and heavy insulation and adequate handle ventilation assure cool operation. It is available in light and heavy duty sizes to accommodate electrodes up to 3/8 in. diameter.

Work Positioners

The positioning equipment manufactured by the Ransome Machinery Company, Dunellen, N. J., usually thought of in connection with positioning work for welding, is proving useful in railroad shops for positioning distributor and feed valves, lubricators, condensers, feedwater pumps, cylinder heads, driving boxes, crossheads and other parts for shop operations. These include assembly, overhauling, chipping, grinding and drilling. Positioners range from 100-lb. hand-operated bench models and 500-lb. motor-operated models to 20-ton motor-operated units. All motor-operated models are equipped with constant-

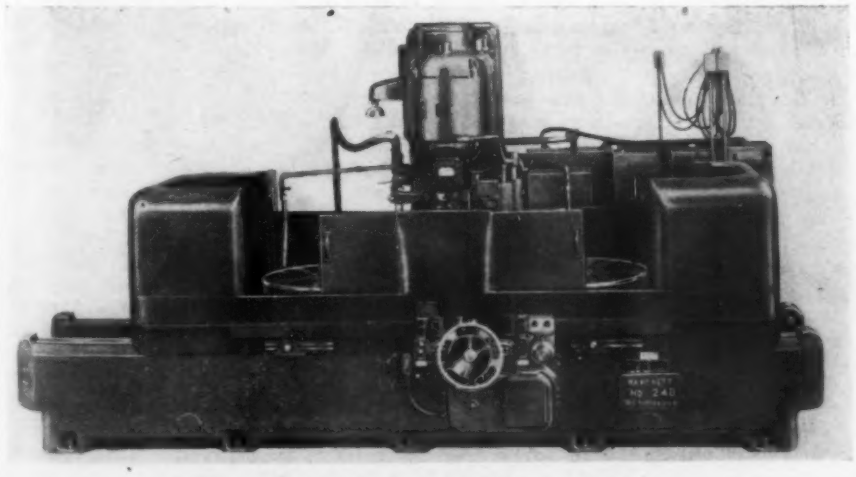
Welding positioner which can be employed usefully in other shop operations

or variable-speed drives for rotated positioned work and the table tops have a tilting range of 135 deg.

Duplex Rotary Surface Grinder

The Hanchett No. 24 duplex rotary surface grinder, a product of the Hanchett Manufacturing Company, Big Rapids, Mich., has fingertip control incorporated into the machine for separate operation of its two rotary work tables. The machine is equipped with two magnetic chucks intended to eliminate much of the downtime required for cleaning and reloading. Two direct-current motors, attached to the underside of the carriage, drive the magnetic chucks at variable speeds and are controlled from push-buttons centralized within instant reach of the operator.

A 25-hp. 900 r.p.m. motor of the built-in type is used to run the grinding wheel. Fine finishes are obtained with segmental-type grinding wheels. Other equipment includes two 30-in magnetic chucks, an 18-in. segmental wheel chuck fitted with a set of grinding segments, necessary small motors and controls for head feed and carriage traverse, two drum-type demagnetizing switches, an ammeter for the wheel motor, a flood light, a wheel dresser, and a wet grinding system including two motor-driven coolant pumps and tanks.



Duplex surface grinder equipped with magnetic chucks

Electrode For Heavy Work

A heavily covered arc-welding electrode for flat and horizontal fillet welding as well as for flat butt welding has been announced by the Electric Welding Division of the General Electric Company. Designed for

The GE type W-27 arc-welding electrode being used on a steel machine base

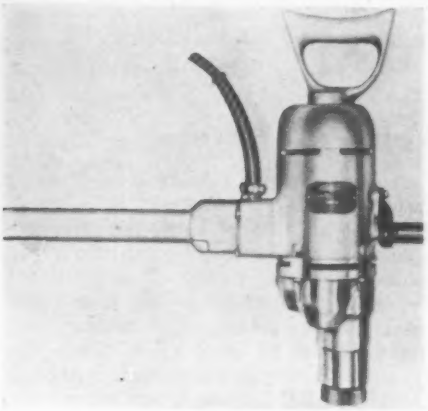
weld requirements which include high mechanical properties, rigid X-ray examination, good profile, high deposition rate, and good surface appearance, the applications of the electrode include pressure vessels and pertinent connections, heavy machine bases, and structural parts such as column plates, columns, roof trusses, beams and girders where the thickness of the section permits.

Known as type W-27, the electrode is characterized by a high melting rate which permits increased production and higher speeds at the same welding current as other electrodes. At comparable production speeds, it requires less heat input to the joint, thus reducing warpage and internal cooling stresses.

The electrode operates on alternating current or direct current with either straight or reverse polarity. It has low spatter loss and easy slag removal and produces welds of good appearance. It is available in three sizes: 3/16 by 18 in., 1/4 by 18 in., and 5/16 by 18 in., and is rated A.W.S. classes E6020 and E6030.

Portable Ball-Bearing Drill

A large and powerful electric motor-driven drill, produced by the Black & Decker Manufacturing Company, Towson, Md., has a drilling capacity in steel for holes ranging in size from 1/8-in., using a suitable reducing sleeve, to 1 1/4 in. with its standard chuck. The motor housing is cast with an adapter pad which permits the drill to be fastened to a drill stand if desired; for hand use it employs a spade handle and



Heavy-duty electric drill

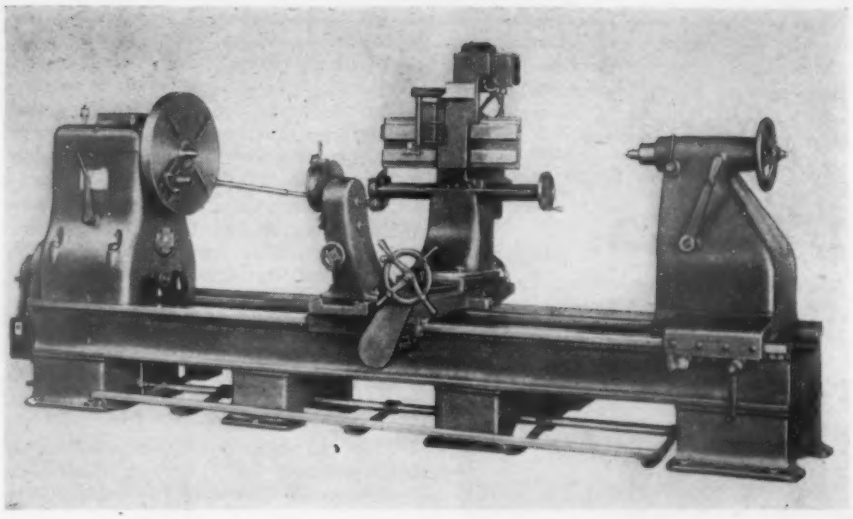
a pipe handle. The tool can be used for light reaming up to a 1-in. diameter hole and for heavy reaming up to 3/4 in. Under full load it has a spindle speed of 160 r.p.m.

Standard voltage for operating a universal motor is 110 but units using 220 or 250 volts can be furnished. In addition, although the standard no-load speed rating is 250 r.p.m., the drill can be furnished with no-load speeds of 350, 600, 800 and 900 r.p.m.

Heavy-Duty Armature Machine

A heavy-duty armature machine developed by the Electric Service Manufacturing Company, Philadelphia, Pa., is capable of banding armatures up to 45 in. in diameter having shafts up to 96 in. long, and allows a 47-in. swing for the carriage. The tension device will travel or feed to within 4 in. of the headstock centers and 8 in. of the tailstock centers.

Two selective mechanical speed changes are provided, giving speeds ranging from 11 to 80 r.p.m. It is possible to grind and



Armature machine with commutator slotting attachment and banding device in position

true commutators 30 in. in diameter with lengths up to 19½ in. The tension device will handle steel or bronze wire of No. 10 B&S gauge at any tension up to 500 lb. The commutator under-cutting attachment will service commutators from 5 to 30 in. in diameter and 19½ in. in length.

Vertical Motors

The Crocker-Wheeler Division of Joshua Hendy Iron Works, Ampere, N. J., has announced an addition to its line of protected-type a. c. motors, consisting of a vertical drip-proof motor. It is rated at 40 deg. C rise continuous duty with a 15 per cent service factor and is designed for operation from 60 or 50 cycle, three- or two-phase circuits at all standard voltages. At present NEMA B flange type mountings up to and including the 284 frame, and NEMA C face type mountings up to and including the 326 frame are available.

All ventilating openings of this new line of motors are shielded against the entrance of dripping liquids and falling particles. Oversize ball bearings are provided which carry thrust in addition to the rotor and centrifugal bearing seals permit the use of softer grease for better lubrication and longer bearing life.

A recessed junction box allows ample room for making electrical connections. Rotor bars, fans and end rings are cast in one operation from aluminum alloys. The frames are of cast construction and coils are protected with Vinylastic insulation.

Drip-proof construction, cast rotor bars and Vinylastic insulation are used to insure uninterrupted service

Low Brightness Fluorescent Lamp

The General Electric Lamp Department, Nela Park, Ohio, has announced a low brightness 40-watt, 4,500-white fluorescent lamp in the 100-watt lamp size. It is designed to produce good quality illumination without the need for the same amount of accessory shielding as is required for standard fluorescent lamps.

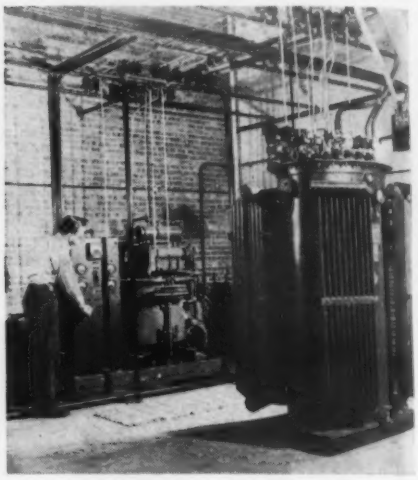
Giving relatively low brightness, reduction in shielding can be accomplished without an appreciable or corresponding increase in glare. A starting stripe, running lengthwise along the tube of the new lamp, facilitates starting. The lamp is suitable for use under any condition of humidity normally encountered. For most uses, longitudinal shielding only will be needed.

The 40-watt lamp in a bulb normally used for the 100-watt lamp has slightly more than one-half the brightness of the standard G-E 40-watt, 48 in., T-12 white fluorescent lamp. It is instant starting; has mogul bi-pin base; shorted base pins; standard mogul bi-pin lampholders, and is used with regular instant starting ballasts designed for 40-watt lamps. Preheat 40-watt ballasts may be employed with the new SS-400 "Jack Rabbit" split-second starter when available. Rated initial lumens are 2,000.

Converter For Induction Heating

A mercury-arc converter for the low-frequency range of electronic equipment required in induction heating applications has been announced by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Designed for electronically changing power at commercial frequencies of 60 or 25 cycles into 1,000- to 2,000-cycle power, the frequency changer is suitable for supplying power for forging, melting, and metal-treating applications where large masses of metal or metal parts must be efficiently heated with this power at kilowatt capacities of 250, 500, 1,000 and higher.



Mercury-arc converter for low-frequency induction heating

Two applications of the converters have been made in the past year, one being a 300-kw. unit in a forge plant, and the other a 250-kw. unit in use in the melting section of a brass foundry.

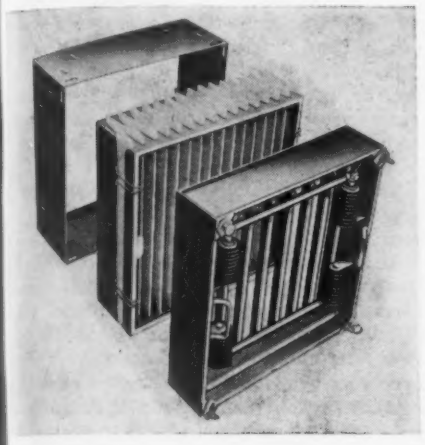
Electronic Air Filters

A recent addition to the line of electronic air filters made by the American Air Filter Co., Inc., Louisville, Ky., is the Electro-Airmat in which the collector element is electrostatically charged Airmat paper. Weighing 40 per cent less than electronic filters having metal plate collectors, the Electro-Airmat has an arrestance rating of 90 per cent or better with atmospheric dust and smoke.

Airmat is a cellulose product composed of a number of plies of porous, tissue-like sheets formed of short cellulose fibers in "jack-straw" arrangement. When an electrostatic charge is applied to the paper, the plies tend to separate and each individual fiber becomes a collecting electrode which attracts and holds the dust and smoke particles. It is also a mechanical filtering media and affords protection against the infiltration of dust through air-conditioning systems of railroad coaches placed on sidings or when the power is off for any other reason.

Ease of installation and economy and

convenience of maintenance are features claimed for the Electro-Airmat. The power pack which furnishes the voltage for the filter operates on 110-volt 60-cycle single-phase current. Total power consumption is approximately 220 watts at 110 volts, including transformer losses in the power pack. When the filter has accumulated its dust load, it is removed and replaced with



The three essential parts of an Electro-Airmat filter

clean material by turning a crank in a mechanical loader which automatically folds the paper into the serrated base section of the filter unit. Spare cells loaded with clean filters can be provided at convenient terminal points.

Ballasts for Fluorescent Lighting

The American Transformer Company, Newark, N. J., has introduced a line of ballasts for hot- and cold-cathode fluorescent lighting. The manufacturer claims for the ballasts an exceptionally close matching with tube characteristics, assuring maximum lamp life and maintained brightness. It is also claimed that flicker, end-blacking and premature burn-outs are reduced.

The ballasts will fit all standard fixtures and are suitable for interior or exterior channels

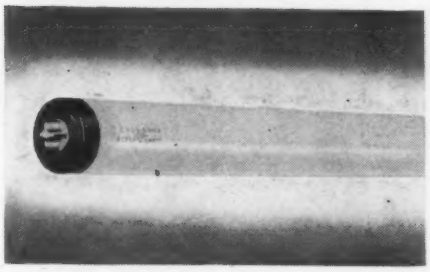
Being quiet in operation they are recommended for installations where the noise level is low.

The ballast has a roll-turn lead-out that prevents strain on lead insulation and facilitates wiring. Since this lead-out is of the two-way type, it may be attached to exterior or interior channels, thus reducing the number of ballasts which need be stocked. Their dimensions make the ballasts adaptable to all standard fixtures.

Cold-Cathode Lamp

Introduction of a cold-cathode K lamp has been announced by Sylvania Electric Products, Inc., Salem, Mass. The lamp, which will be made in both 72 in. and 96 in. lengths of T8 (1 in.) diameter, will be instant starting and will have a rated life of 10,000 hours. On and off operation will have virtually no influence on reducing the life of the lamp.

The base of the K lamp employs a special contact pin which fits into a lampholder punched with a hole of similar design. The variation in the design of the base was made to prevent the LS type fluorescent lamp from being inserted in a circuit designed for the K lamp, or cold-cathode type of ballast, as the two lamps have different starting and operating characteristics. The lamp is especially adaptable for installations where maintenance is either difficult or costly.



A special base avoids the possibility of applying an LS type lamp in a circuit designed for cold-cathode operation

High-Tensile Steel

Otiscoloy is a high-tensile steel manufactured by the Jones & Laughlin Steel Corporation, Pittsburgh 30, Pa.

Excellent welding and forming characteristics are claimed as important features of this steel which may be hot-formed or cold-formed. Hot forming may be done without affecting its inherent properties. Its cold formability is only slightly less than that of ordinary low-carbon steels and the bending radius can be safely taken at twice the thickness of the material without encountering difficulties. It is also capable of performing satisfactorily in moderately severe drawing operations. The usual careful shop procedure employed in welding low-carbon and medium-carbon steels is said to produce stronger and more ductile welds in this steel. No excessive hardnesses are obtained and no brittle zones develop adjacent to the welds.

The steel is said to be corrosion and abrasion resistant. In sheet and strip form as well as in plate from $\frac{5}{16}$ in. to $\frac{1}{2}$ in. in thickness, its physical properties are:

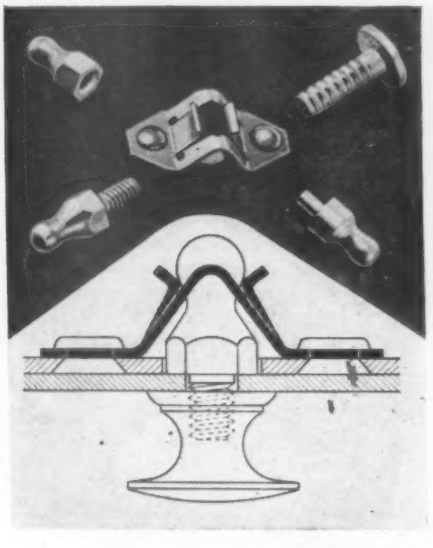
Tensile strength, min., lb. per sq. in.	70,000
Yield point, min., lb. per sq. in.	50,000
Elongation in 2 in., min., per cent	25.0

These values are slightly less in plates over $\frac{1}{2}$ in. in thickness.

The physical property values are subject to some adjustment depending upon requirements of specific applications. Those given are typical values.

Spring-Steel Latch

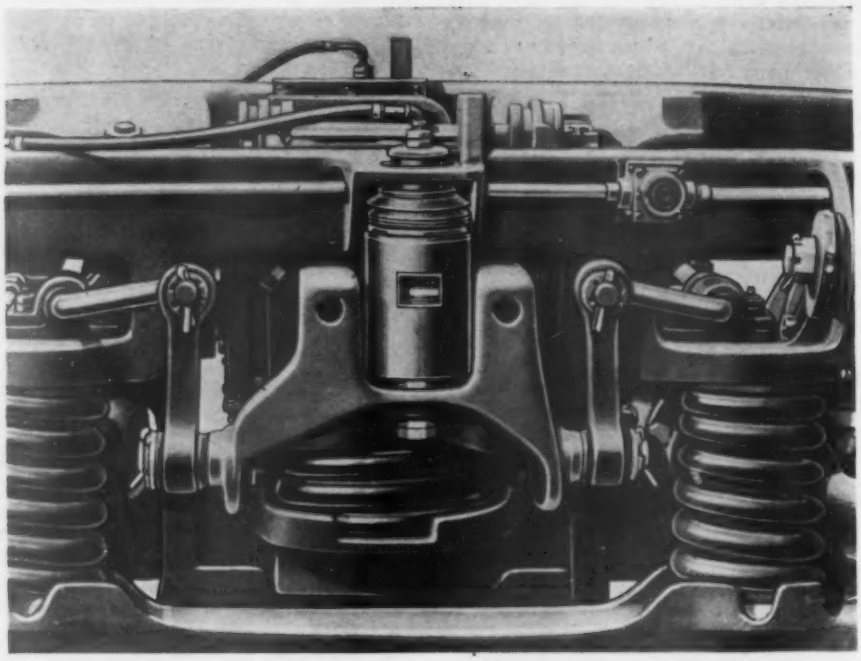
A spring-steel speed-nut latch has been developed by Tinnerman Products, Incorporated, Cleveland 13, Ohio, for instant attachment and removal of box covers, access doors, panels and inspection plates. Spring arms of the speed nut snap over ball or grooved studs to provide firm attachment, yet studs may be withdrawn quickly. It is available in five degrees of pull-out tension. Three styles of ball studs are available: drilled and tapped for 6-32 screws; threaded shank with a 6-32 thread; and, plain shank for riveting. They are furnished in various lengths to suit application requirements.



Parts and application drawing of speed-nut latch

Hanna Glide-Ride Air Cylinder

A cushioning device, designed for use on passenger-car trucks in high-speed service, has been developed by the Hanna Engineering Works, Chicago, and is known as the Glide-Ride air cylinder. Flexibly connected between the truck bolster and the main frame, this cylinder (two per truck) operates on compressed air taken from the signal line through a $\frac{1}{32}$-in. restricted opening and utilizes an ingenious patented piston construction which permits the truck springs to function freely under light road shocks, but builds up pressure rapidly and supplies an effective air cushion to supple-



Hanna air cylinder installed between truck frame and bolster to give smooth riding in high-speed passenger service

ment spring action as required under heavier shocks.

Being double-acting, the cylinder also cushions rebound and, with one cylinder installed on each side of each truck, car sway on curves is minimized and cars permitted to negotiate the rougher sections of track more smoothly and at higher speeds than would otherwise be possible. An adaptation of this cylinder is also being developed for use in a cross-horizontal position between the rear truck frame and the spring plank to minimize the whip action of observation car ends while passing curves at high speed. In preliminary road service tests of one car set of these air cylinders on a Chicago, Milwaukee, St. Paul & Pacific passenger car which has made about 150,000 miles in the last year the cylinders functioned as intended and received no mechanical attention other than occasional inspection.

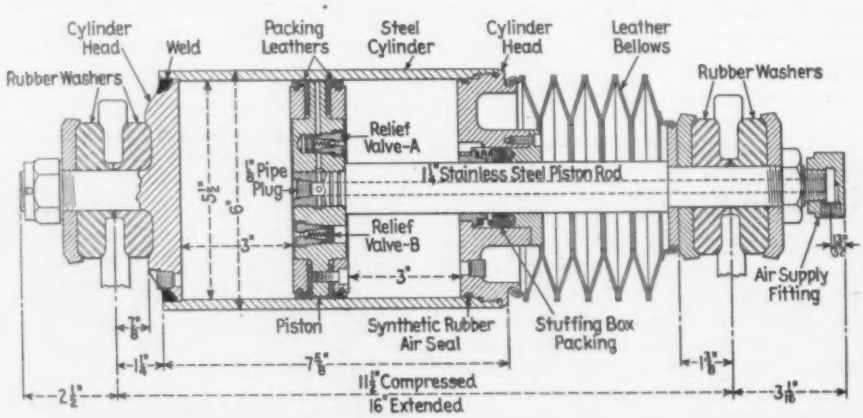
Referring to the drawing, the construction of the Glide-Ride air cylinder and piston will be apparent. The cylinder consists of a 5½-in. seamless-steel tube with a steel head welded in the lower end and the upper head screwed in place, with a synthetic rubber gasket to prevent any possibility of air leakage. The built-up piston has a travel of 4½ in. in this cylinder and is constructed with two spring-supported packing leathers; annular ports lead from the center of the piston to the cylinder walls between the packing leathers; and two spring-loaded relief valves usually set for 100 lb. admit air through a ⅛-in. port hole above each ball check and pass it through a 1/32-in. hole in the plug at the other end.

Valve *A* thus passes air in excess of 100 lb. from above the piston back into the air-supply line at the piston center. Valve *B* simply passes excess air from below to above the piston. The stainless-steel piston rod, suitably packed to prevent leakage of air through the stuffing box, is hollow bored and takes air from a special fitting and 1/32-in. orifice in the air-signal supply line and delivers it to the center of the piston. The leather bellows, illustrated, protects the piston rod against dirt and moisture. Necessary flexibility in attachment of the cylinder between the bolster and truck frame is secured by means of rubber washers inserted between steel supporting plates on the upper and lower anchor bolts.

In operation, the piston normally rides at about the center of the cylinder. Air is admitted at signal-line pressure of 65 lb. through the hollow piston rod to the piston center, from which it is delivered through three lateral holes to the piston walls and thence past the packing leathers until pressures are equalized on both sides of the piston. Any upward movement of the piston then compresses air above it and permits air to flow past the bottom leather into the space below. Similarly when the piston moves downward air pressure is built up below the piston and additional air is drawn in above.

This pumping action continues until air pressure is built up to 100 lb. pressure on both sides of the piston permitting it to float freely under light road shocks and small spring travel. In case excessive shock carries the piston nearly to the top of the cylinder, air pressure builds up rapidly to resist and finally stop this movement. The excess air is then slowly exhausted through relief valve *B* to the underside of the piston. Rebound is similarly cushioned when the piston moves towards the bottom of the cylinder, only in this instance the excess air passes through relief valve *A* back into the air supply line. Since there is no loss of air to the atmosphere very little air is required for operation of the cylinders. The cooling effect when air expands through the relief valves is said to offset heating due to compression, so there is no material increase in temperature.

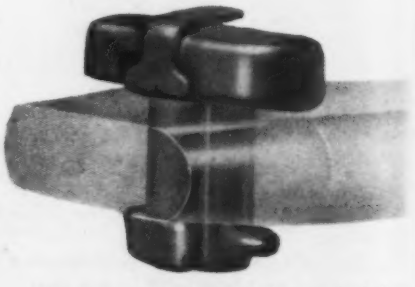
The Glide-Ride air cylinder for railway passenger cars is a patented device, the principle of which has been thoroughly tested on other types of vehicles. It is simple and no mechanical parts require close tolerances or frequent adjustment.



Cross-section showing details of construction of Hanna Glide-Ride air cylinder

Draft-Key Retainer

The Illinois Railway Equipment Company, Chicago 4, is now distributing an improved draft-key retainer which has the approval of the A.A.R. as an acceptable alternate standard. It replaces the plug retainer which is held in place by a cotter and is intended to insure against the accidental removal of a retainer and subsequent displacement of the draft key. The device consists of a grooved plug in which a locking member, shaped to fit the grooved portion of the plug, is inserted and locked in place by bending over a projection on the keeper portion of this member.



Phantom view of application of draft-key retainer

Patch Bolts

Hardened self-tapping patch bolts are offered by the Parker-Kalon Corporation, 200 Varick Street, New York 14, as being most effective for making repairs to passenger-car side sheets without the necessity of tearing out any interior trim. They are applied through holes punched or drilled in the replacement sheet to match the holes

Patch bolt used in applying passenger-car side sheets

in the structural members of the car. The bolts are turned in with a socket or an end wrench and, when firmly seated, the square headshank of the bolt is removed with a hacksaw, bolt cutter or chisel. The head is then dressed down to a standard round contour with a file.

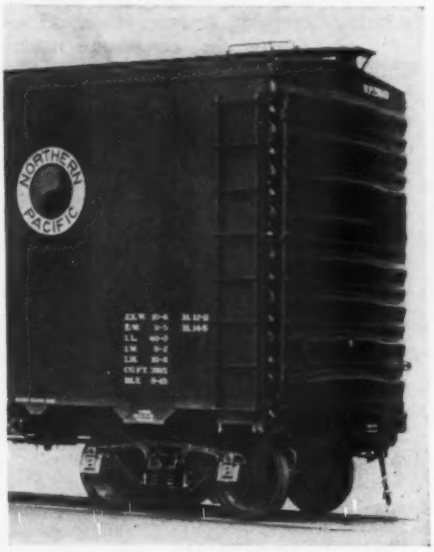
Marlite Interior Paneling

Adaptable to a wide variety of applications in railway car construction, attractive and durable Marlite interior paneling, made by Marsh Wall Products, Incorporated, Dover, Ohio, is manufactured in a complete range of colors and patterns that meet any installation requirements and will complement any decorative scheme. Attractive wood veneers and wood patterns have already gained popularity for use in lounge cars, club cars and dining cars where warm and pleasing interiors are required.

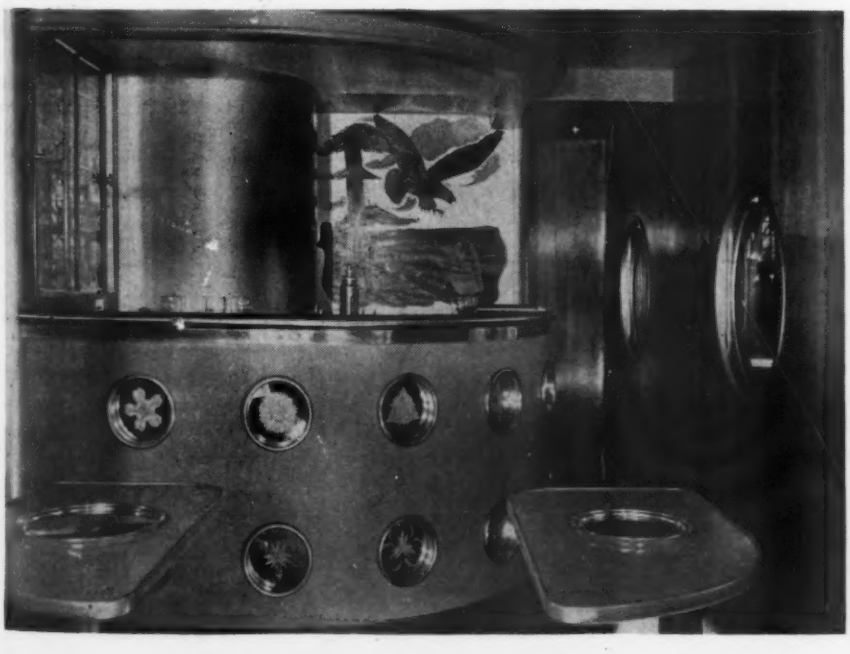
Marlite plain colors and tile patterns with a high-heat bake finish and heat-resistant, are available for finishing off sanitary facilities in cars, as well as in other locations where modern and easy-to-clean interiors are required. A sealed surface which is resistant to moisture, grime, mild acids and human hair oil reduces maintenance upkeep and provides an attractive, colorful interior. Delivered in large, wall-size panels, Marlite is quickly and easily cut and applied.

Box-Car Ends

The Standard Railway Equipment Company, Hammond, Ind., has changed the design of its Dreadnaught steel end for box cars to provide a 1-in. increase in the depth of corrugation. Corrugations are now 4-in. deep and they are reinforced



The depth of corrugation has been increased in this box-car end



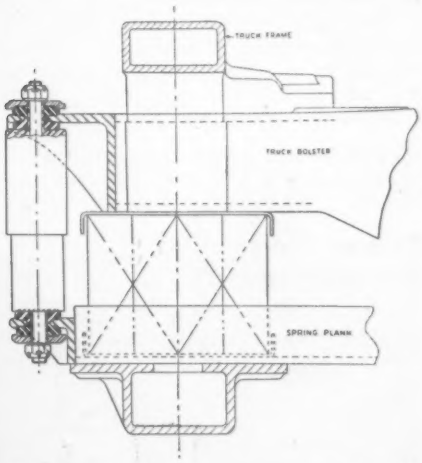
Bar in a lounge car finished with Marlite panels

on the compression side since tests made by the company have indicated that failures developing in service occurred on the compression side before they did on the tension side. The use of this improved corrugated beam construction in combination with the semi-restrained beam action of W-section corner posts results in substantially increased strength and the possibility of weight saving, particularly when high-tensile steels are used.

This company has also announced a new design of gondola-car end which provides space in the corners of the end for the use of a W-section corner post construction. The advantages of this type of corner are available without any interference with the inside dimensions of a car.

Hydraulic Shock Absorbers

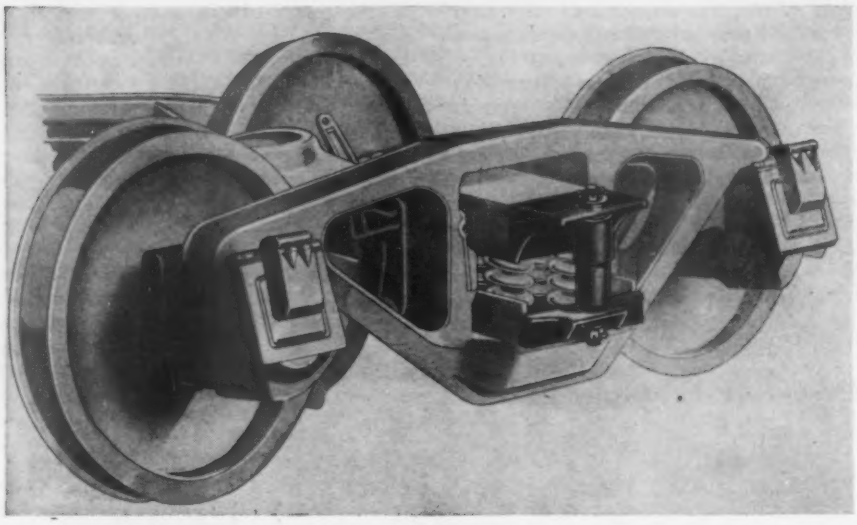
Direct-action two-way hydraulic shock absorbers for freight cars now are well past the experimental stage and are being thoroughly tested on refrigerator and tank cars with excellent results, according to an announcement of the Monroe Auto Equipment Company, Monroe, Mich. The freight-car shock absorbers are similar in design and type of mounting to those used successfully on new streamliners and other passenger equipment. In their development, Monroe has combined improvements made over nearly seven years in shock absorbers for rail passenger cars with experience recently gained in the volume production of direct-



Hydraulic shock absorbers are mounted outside the spring nest between the bolster and the spring plank

action two-way hydraulic shock-absorbing devices for heavy tanks and trucks used in the war.

Tests so far have shown that the two-way hydraulics lessen to a minimum the number of times when springs go solid and control rebound as well. The two-way shock absorbers, taking the shock load off the bearings of the freight-car trucks, act to lessen wear on all parts of the car including the springs, brakes, wheels and axles. Comparative tests of tank cars equipped with the two-way hydraulics and cars not so equipped showed that on cross-country runs the steel straps holding the



Hydraulic two-way shock absorber shown as it would be mounted on a freight-car truck

tanks on the cars without the shock absorbers worked loose. Resultant sloshing of oil in the tanks, increasing sidesway and shock, caused so much wear and tear that it was necessary to make major repairs before the cars were again ready for service. Straps on the hydraulically equipped cars remained tight.

Other experiments are said to have disclosed that breakage losses on such products as eggs and other perishables and tile were reduced materially when cars were equipped with two-way hydraulic shock absorbers. This extended even to meat which is hung on hooks in the cars. Cushioning with the two-way shocks cut down the percentage of meat falling off the hooks and thus being damaged.

These shock absorbers are mounted on the outside of the freight-car trucks between the bolster and the spring plank, and do not take the place of the springs. Full spring action is retained.

Front End Arrangement

The Amweld locomotive front end arrangement has been announced as the first product of the newly formed Railway Equipment Division of the American Welding & Manufacturing Company, Warren, Ohio, following acquisition by the company of manufacturing rights to the basic Locomotive Economizer Corporation patents and designs. The device is intended to provide a free and uniform flow of gases to the locomotive stack while offering maximum impedance to the sparks and cinders. Of unit construction and individually engineered, this front end may be installed with a minimum of fitting in any of the principal types of locomotives. With necessary supports, it consists essentially of a streamline housing of $\frac{3}{16}$-in. steel which totally encloses the exhaust-steam entry and stack outlet. Louvres of 1¾-in. by 1¾-in. by ¼-in. angles are located at the front and sides of the housing to provide an easy exit for flue gases while serving to arrest sparks.

The application of aerodynamic principles to the design of the housing and arresters is said to contribute much to the efficiency of operation of the unit by permitting the use of a larger exhaust nozzle, reducing the back pressure on the cylinders below the range normally encountered. In addition to increasing draft through improved airflow to the stack, the curvature of the housing tends to equalize the draft through the flues. The central flues, which would normally bear the burden of the draft, are restricted so as to apportion the load more evenly. This equalized draft tends to eliminate concentrated burning and to result in an even firebed with an accompanying reduction in fuel consumption.

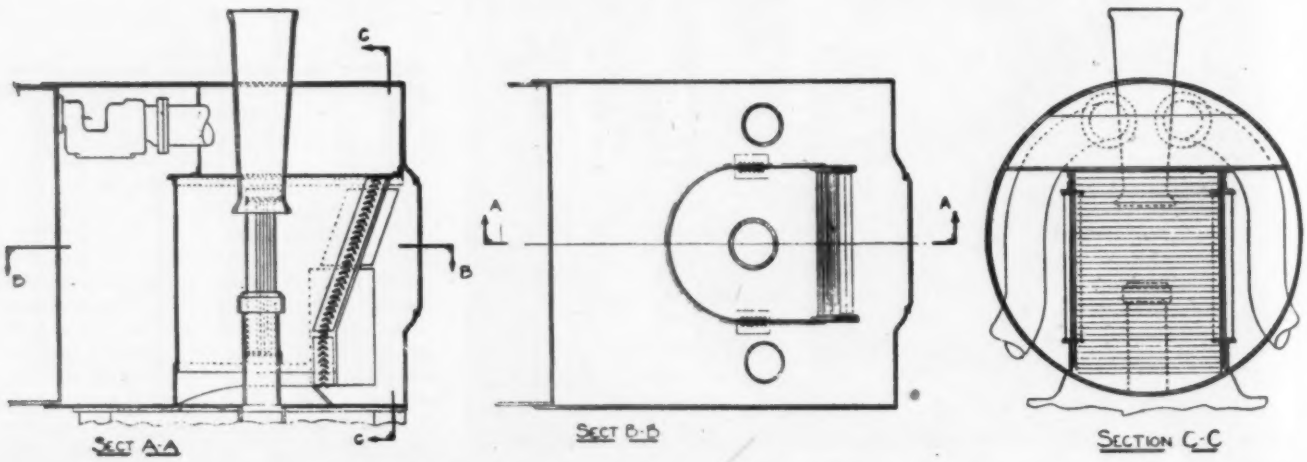
The combination of louvre design and location is said to be particularly suited to reducing both the size and quantity of cinders emitted from the stack. Larger cinders never enter the louvres, being excluded by their size and inertia; these drop down to the bottom of the unit where they may be cleaned out periodically. Smaller cinders which succeed in entering between the first legs of the louvres break up on impact with the second leg and are pulverized to unobjectionable size.

Maintenance problems in connection with this front end are considerably simplified. Flue cutting, the result of the abrasive action of cinders travelling through the flues, is related to their velocity of travel. By equalizing draft, flue cutting is minimized as a result of lessened cinder velocities. Repair work is further lessened by the substitution of rolled-steel louvres for conventional nesting, thus eliminating the familiar problem of clogged and burned-out netting.

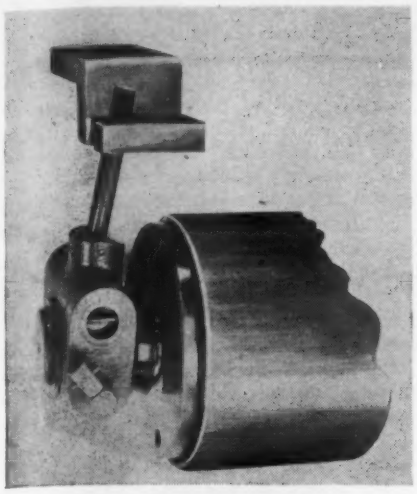
Speed Indicators

Railroad speedometer equipment being manufactured by the Jones Motrola Corporation, 432 Fairfield avenue, Stamford, Conn., can be applied to any type of locomotive, steam, Diesel, electric, or gasoline. These speed indicators with cab-mounted gauges are standard equipment on the locomotives of a number of roads and are used on some locomotives by others.

An installation consists of speedometer head actuated by a fly-ball governor, a flexible shaft of suitable length, and a drive unit. There are two models of drive units, one designed for use with roller-bearing mounted axles, and the other for plain friction type bearings. For roller bearing axles, the drive unit is mounted on the cover of the box, as alignment and end movement of the axle are controlled. A forked angle fastened to the end of the axle engages the cross bar and drives this unit. For plain-bearing axles the drive unit is mounted directly on the end of the



Diagrammatic views of Amweld locomotive front end arrangement



Mounting for speedometer drive unit on a plain-bearing axle

axle and moves up and down and laterally as an integral part, eliminating the problem of alignment. A suitable bracket on the top inside of the box engages the vertical rod and keeps the housing from turning.

Smoke Nozzle Silencer

A silencer is now furnished by the T-Z Railway Equipment Company, Chicago, in a unit assembly with the smoke-preventer nozzle which it has been furnishing to the railroads. One end of the nozzle is machined and fitted into a combustion sleeve, and the other end is fitted with a ½-in. pipe nipple 3 in. long. The silencer, fitted around the nozzle, consists of an outside shell made of a steel stamping and an inner shell made of hardware screen. A ½-in. blanket of acoustic material is placed between them. This assembly is held firmly in place by a gland nut which fits around the nipple.

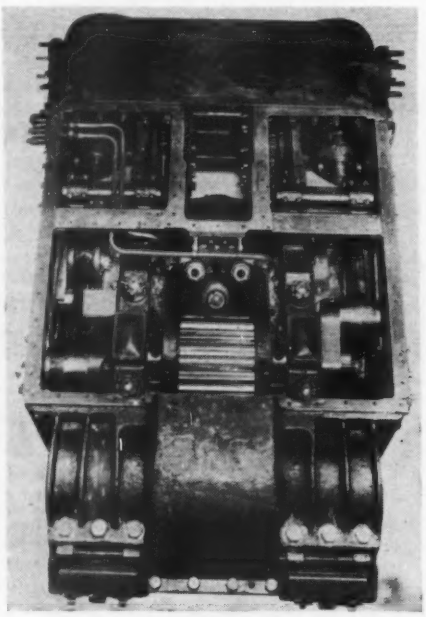
The design permits the silencer to be removed easily and quickly so that it can be cleaned and the acoustic material or the smoke-preventer nozzle removed if necessary. The bracket which holds the unit may be attached to the outside firebox sheet in any position to prevent interference with staybolt heads, piping, and other parts. It is essential that a 1-in. opening be provided between the silencer and the outside firebox sheet so that the correct amount of air will be drawn into the unit.

Franklin Changes Locomotive Booster

The Franklin Railway Supply Company, Incorporated, New York 17, has recently made a number of improvements in its Type E booster. This booster is now designated as the Type E-1 and provides for operation up to 35 m.p.h. and can be placed in operation at speeds up to 22 m.p.h.

The steam passages of the cylinder have been redesigned to produce a better steam flow. The pistons are made from cast steel and equipped with sectional packing. The axle bearing cap is designed to allow the use of through bolts. Stops for valve and cylinder bushings have been provided on valve chest heads and the cylinder heads. The crank shaft has a strengthened crank-arm fit. Principal parts of the valve gear, such as the eccentric crank, eccentric rod and valve rocker, are made from heat-treated alloy steel to increase their strength.

The Type E-1 booster can be furnished with Alemite lubrication for the crank shaft, bearings and the idler-gear bearing, which permits applying grease to these bearings from the outside if this is desired.



Type E-1 booster suitable for service at speeds up to 35 m.p.h.

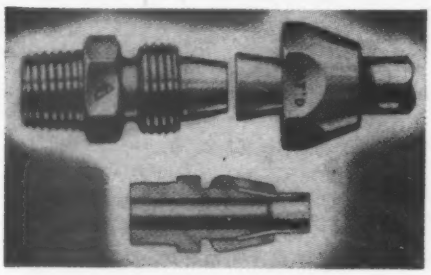
Rust Inhibitors

Two types of rust inhibitors, Carbo C and Carbo N, which have been designed for temporary rust prevention on metallic materials during inside storage, have been developed by the Carbozite Corporation, Pittsburgh, Pa. Carbo C inhibitor, the more universal of the two is inactive on all metals and alloys, including magnesium and aluminum, while Carbo N inhibitor has no effect on iron, steel or ferrous alloys, although it does have a slight action on softer metals, such as lead, zinc, magnesium and aluminum.

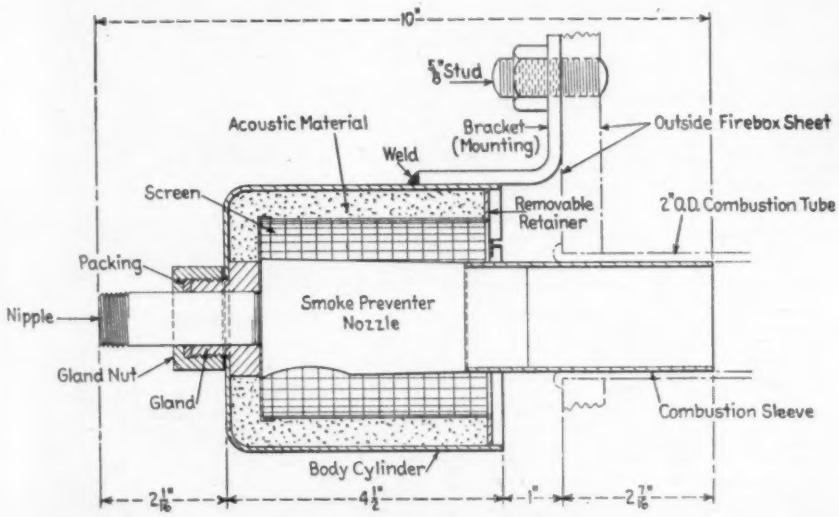
Carbo C and Carbo N prevent rust in lines that drain salt solutions and can be also used in a mixture with cutting oils to protect threads from rust. Both Carbo C and Carbo N are distributed in concentrated form only, and are mixed in proportions of from 25 to 100 gals. of water for each gallon of inhibitor.

Flared Tube Fittings

Leakproof joints even under maximum vibration and pressure are said to result from the use of flared tube fittings manufactured by the Grinnell Company, Providence 1, R. I. These are two-part fittings which are so designed that there is no shearing action to injure the tubing at the point of flare when the nut on the fitting is tightened. No reduction in diameter of the tubing results when the fittings are applied and there are no obstructions at the joint. Stock sizes of these fittings are available in steel up to ½ in. outside diameter and in malleable iron up to ⅝ in. outside diameter. Stainless-steel and brass fittings can be furnished.



Two-piece flared-tube fitting



Arrangement of smoke nozzle silencer

NEWS

A.S.M.E. Railroad Division Program for 1945 Meeting

THE Hotel Pennsylvania,, New York, will be the headquarters for the 1945 annual meeting of the American Society of Mechanical Engineers which is scheduled for the week beginning Sunday, November 25. Among the divisions to hold sessions are Fuels, Applied Mechanics, Railroad, Oil and Gas Power, and Heat Transfer. Fuels will be discussed along the lines of railroad requirements as originally planned for the Chicago semi-annual meeting which was cancelled because of O. D. T. regulations. One session of the Oil and Gas Power Division will be devoted to oil and gas power, two to gas turbines, and the fourth to a symposium on gas turbines. Thursday, November 29, will be Railroad Day and the annual luncheon of the division will be held at noon. At 8:15 p.m. the Railroad Division will hold a joint session with the Applied Mechanics Division. The technical sessions for the day are as follows:

RAILROAD DIVISION

Thursday, November 29

9 a.m.

Railroad Motive Power Trends, by Ralph P. Johnson, chief engineer, The Baldwin Locomotive Works.

2 p.m.

Railroad Passenger Cars—1946 Models, by A. W. Clarke, assistant general mechanical engineer, American Car and Foundry Company.

Tests of Oil-Film Journal Bearings for Railroad Cars, by S. J. Needs, Kingsbury Machine Works, Inc.

JOINT SESSION RAILROAD AND APPLIED MECHANICS DIVISIONS

8:15 p.m.

Crank-Pin Design for Locomotives, by O. J. Horger, chief engineer, Railway Division, The Timken Roller Bearing Company, and W. I. Cantley, mechanical engineer, Association of American Railroads.

Design and Application of Rail Transportation Gearing, by D. R. Meier and J. C. Roads, General Electric Company.

The Railroad Division will also hold a joint meeting with the Fuels Division on Wednesday, November 28, at 2 p.m. when there will be a Symposium on the Utilization of Solid Fuels in Railroad Motive Power. The speakers will be K. A. Browne, research consultant, Chesapeake & Ohio; C. F. Hardy, chief engineer, Appalachian Coals, Inc.; A. A. Raymond, superintendent fuel and locomotive performance, New York Central System, and R. A. Sherman, supervisor fuels division, Battelle Memorial Institute.

USS Cor-Ten Cars After Ten Years' Service

IN celebration of the tenth anniversary of the first substantial application of USS Cor-Ten steel, the Carnegie-Illinois Steel Corporation exhibited on October 10 at the Homestead steel works, Pittsburgh, Pa., a group of 14 light-weight freight cars of several types which have been in service during a major part of the period since the development began. Twelve of the cars were originally built of Cor-Ten steel and two were test cars in which the service of Cor-Ten steel was compared with that of Man-Ten steel and hard aluminum alloy. During the afternoon these cars were inspected by members of the Car Construction Committee of the Association of American Railroads, Mechanical Division, and of the American Railway Car Institute Committee on Freight-Car Design then meeting at Pittsburgh. The party were guests of the steel company for luncheon and dinner.

The largest group of cars comprised seven Bessemer & Lake Erie 50-ton light-weight hoppers. These were from the lot of 100 USS Cor-Ten cars weighing a few hundred pounds over 30,000 each which were built in 1935 and have since been in continuous heavy service on the home road. In the design of these cars very thin sheets were employed. The side sheets and top floor sheets were 3/32 in. thick; the bottom floor sheets 1/8 in. thick, and the hopper sheets 5/32 in. thick. The interiors of these cars present the characteristic, uniformly pitted appearance of Cor-Ten steel with no accumulations of heavy spalling scale characteristic of carbon steels. With one exception, there was no visual evidence that any of the sheets in these cars had been weakened by corrosion, although there were signs of more than average corrosive conditions at the horizontal riveted joint between the side sheets and hopper sheets. In one hopper car there were short breaks in a side sheet near the lower end of the joint between the side sheet and the hopper slope sheet. The thickness of the sheet at the fracture and other evidences of mechanical damage of the floor sheets suggest that the breaks in this sheet were due to causes other than corrosion.

The general condition of the sides and

Orders and Inquiries for New Equipment Placed Since the Closing of the October Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Central of New Jersey	3[1]	2,000-hp. Diesel-elec. pass.	Baldwin Loco. Wks.
Missouri-Kansas-Texas	2[2]	2,000-hp. Diesel-elec.	Electro-Motive
St. Louis-San Francisco	2[3]	2,000-hp. Diesel-elec.	Electro-Motive
Union Pacific	1[3]	3-unit 6,000-hp. Diesel elec.	Fairbanks-Morse & Co.
	1[3]	4-unit 6,000-hp. Diesel-elec.	Electro-Motive

FREIGHT-CAR ORDERS

Road	No. of cars	Type of car	Builder
Clinchfield	20	70-ton covered hopper	American Car & Fdry. Co.
Missouri-Kansas-Texas	150	40-ton automobile[4]	Company shops
	50	50-ton automobile[4]	Company shops
Reading	1,000	50-ton box	Company shops
St. Louis-San Francisco	300[5]	50-ton automobile	Pullman-Standard
	200[5]	70-ton hopper ballast	American Car & Fdry. Co.
	100	70-ton covered hopper	Company shops
	20	Cabooses	Company shops

FREIGHT-CAR INQUIRIES

Elgin, Joliet & Eastern	300	50-ton gondola
	200	50-ton flat
	50	50-ton hopper
New York, Chicago & St. Louis	500	50-ton box
	100	70-ton covered hopper

PASSENGER-CAR ORDERS

Road	No. of cars	Type of car	Builder
Denver & Rio Grande Western Chicago, Burlington & Quincy Western Pacific Missouri-Kansas-Texas St. Louis-San Francisco	6[6]	10-car trains	Edw. G. Budd
	24[7]	2 bagg.-mail	Pullman-Standard
		4 chair	Pullman-Standard
		2 chair-lounge	Pullman-Standard
		2 diners	Pullman-Standard
		12 sleeping	Pullman-Standard
		2 obs.-lounge	Pullman-Standard
Pennsylvania	70[8]	Coaches	Company shops
	5[8]	Double-unit dining	Company shops
	5[8]	Lounge-buffet-obs.	Company shops
	5[8]	Lounge-buffet-bagg.	Company shops

[1] For use in commutation service. The locomotives will be of double-end type; that is, having an operator's cab at front and rear.

[2] For use on the Texas Special between St. Louis, Mo., and San Antonio, Tex.

[3] The three-unit locomotive has been designed for a maximum operation of 65 m.p.h. It will be tested on a run from south of Salt Lake City, Utah, to Los Angeles, Cal., in freight hauling and possibly in passenger service. The four-unit locomotive is to be tested between Green River, Wyo., and Ogden, Utah, under exact loads and conditions to determine comparison of performance of this unit with the Union Pacific's "Big Boys," or 4000 class, 4-8-8-4 type, locomotives. Later tests of the new locomotive will also be conducted between Salt Lake City and Los Angeles.

[4] With loading devices.

[5] Pending approval by the United States District Court. The automobile cars will cost $1,639,500; the hopper ballast cars, $895,000.

NOTE: The St. Louis-San Francisco has petitioned the United States District Court for permission to purchase three 4,000-hp. Diesel-electric road engines as part of proposed spending of $7,321,394 on post war equipment for the road's passenger and freight service.

[6] The six trains of stainless steel construction, will be hauled by Diesel power. They will be placed in operation next year between San Francisco, Calif., and Chicago, and will be operated by three railroads jointly under the name of "California Zephyr." The trains will embody all of the most recent developments in design and construction, including cars with the "vista dome" features. The total investment for the cars and locomotives will be approximately $10,500,000, divided among the three railroads.

[7] For two 12-car streamline trains to replace present equipment now operating on the Texas Special between St. Louis, Mo., and San Antonio, Tex.

[8] These cars are to be used to reequip the Trail Blazer and the Jeffersonians, over-night coach trains between New York and Chicago and St. Louis, Mo.

top chord members of these cars indicates that they have stood up well under service requiring frequent passage through car dumpers.

Another hopper car of the same design was one of five built in 1935 for the Pittsburgh & Lake Erie. The side sheets of this car had already failed through corrosion at the junction of the side sheets with the hopper sheets and narrow patches had been applied.

Two test cars for direct comparison of the service of Cor-Ten steel with other materials were also in the exhibit. In one of these cars the comparison is with a hard aluminum alloy and in the other with USS Man-Ten steel. These are from a group of thirteen 50-ton hopper cars owned by the Carnegie-Illinois Steel Corporation which were rebuilt as test cars for comparing USS Man-Ten, copper-bearing steel and aluminum alloy with the USS Cor-Ten. The comparisons were between 3/16-in. and 1/4-in. Cor-Ten, 3/16-in. and 1/4-in. Man-Ten, 1/4-in. copper-bearing steel, and 1/4-in. aluminum. The test has now been completed after an average service to penetration as follows: 3/16-in. Cor-Ten, 51 mos.; 1/4-in Cor-Ten, 66 mos.; 3/16-in. Man-Ten, 24 mos.; 1/4-in. Man-Ten, 36 mos.; 1/4-in. copper steel, 35 mos.; 1/4-in. aluminum, 52S 1/4 hard, 30 mos.

The Bessemer & Lake Erie now has in service over 6,000 lightweight hopper cars of USS Cor-Ten construction with nominal capacities of 70 and 90 tons. These cars were first built in 1936. The bodies of both capacities are the same. The weight of the 90-ton car is 48,500 lb. The side and top floor sheets are 1/8-in. material; the bottom floor sheets of 5/32-in. material, and the hopper sheets 3/16-in. The two cars exhibited are in good condition.

The remaining two cars of the exhibit were 50-ton box cars, one built in 1938 for the Bessemer & Lake Erie by the Pullman-Standard Car Manufacturing Company of light-gauge welded sheets, weighing 38,300 lb.; the other, weighing 43,200 lb., was built by the American Car and Foundry Company in 1941. The body structures of both of these cars are in generally good condition.

AM and FM Radio Systems Tested

FREQUENCY modulation and amplitude modulation radio systems were tested simultaneously under identical operating conditions utilizing equipment of comparable engineering specifications in experiments concluded October 1 by the Atchison, Topeka & Santa Fe and the Farnsworth Television & Radio Corporation

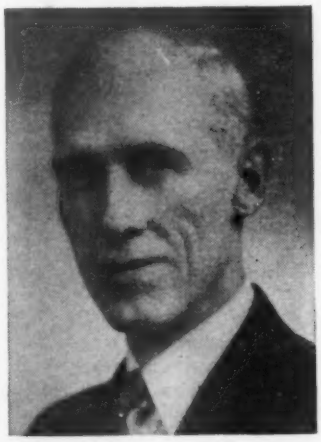
The tests, conducted in the Santa Fe Corwith yards in Chicago, indicated that both FM and AM systems are capable of rendering satisfactory service in railroad operation, according to engineers in charge of the experiments. Both systems, it was pointed out, have certain inherent advantages, and a choice would depend on the economic, installation, operation and maintenance factors involved in individual projects.

The equipment tested for both AM and FM employed the "auto pulse" checking system, in which a small light flashes in the locomotive cab every few seconds when the engine is in operating range of another radio-equipped unit. Because of its safety factor, it was pointed out, this new check system will have many applications in the railway field. The pulse technique employed in this system is an adaptation of a war-time identification development whereby friendly aircraft can automatically identify each other.

The tests were made in the presence of W. N. Krebs, chief engineer of the Safety and Special Services Division of the Federal Communications Commission; Major H. A. Mugliston of the British Army staff. Washington, D. C., and John L. Niesse, New York Central, chairman, and other members of the Train Communications Committee of the Association of American Railroads.

Supply Trade Notes

PITTSBURGH STEEL FOUNDRY CORPORATION, FORT PITT DIVISION.—The Pittsburgh Steel Foundry Corporation, Glassport, Pa., has purchased the plant and equipment of the Fort Pitt Steel Casting Company, McKeesport, Pa., which it will operate as the Fort Pitt Division. *T. F. Dorsey,* who



T. F. Dorsey

has had many years of varied experience at Fort Pitt, has been appointed general manager of the division. Since the first of this year, Mr. Dorsey has been associated with Pittsburgh Steel Foundry in an assistant sales manager capacity. During the previous ten years he had been Fort Pitt's sales manager.

Ralph W. Payne has been appointed southern representative on railway specialties, general castings and machine work, with offices in Washington, D. C., for the Pittsburgh Steel Foundry Corporation, Glassport, Pa.

◆

AMERICAN LOCOMOTIVE COMPANY. — Eleven of the 12 buildings erected by the government on land leased from the American Locomotive Company at the Schenectady, N. Y., plant in 1942 have been purchased by the company and now are devoted to peacetime production. These buildings include four major and seven auxiliary structures. All were used for the production of war materials, including tanks and tank destroyers. The largest of the buildings purchased is the gun tube shop covering an area of 109,000 sq. ft. Others include combat tank assembly and mobile howitzer assembly shops and the

Robert B. McColl

government warehouse, now a Diesel parts warehouse. Some of the buildings now will be devoted to the development of a new line of Diesel locomotives soon to make its appearance.

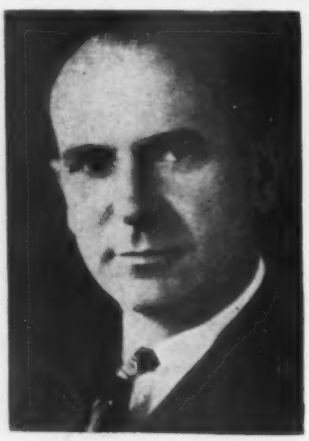
Robert B. McColl, vice-president in charge of manufacturing, has been elected executive vice-president of the American Locomotive Company. *W. L. Lentz,* of Schenec-

Miscellaneous Publications

"A SURVEY IN SEATING."—Heywood-Wakefield Company, Gardner, Mass.—The much-discussed study of body measurements conducted by Dr. Ernest A. Hooton, professor of anthropology at Harvard University, has been published in book form by the Heywood-Wakefield Company, sponsors of the survey. The book reports the findings of the investigations and includes more than 50 tables of correlations prepared by the research staff. In addition to the report of Dr. Hooton's work, the book includes information on the results of an independent survey made by the company on body shapes. The book is available to members of the railway industry without charge.

tady, N. Y., who directed the company's tank and locomotive manufacturing program there during the past five years, succeeds Mr. McColl as vice-president and *J. J. Smith* succeeds Mr. Lentz as manager of the Schenectady plant. *Joseph W. S. Davis* has been appointed assistant district sales manager, New York district, with headquarters in New York. Mr. Davis was previously assistant sales manager of the Railway Steel-Spring division. *John Seagren* has been appointed chief engineer in the Diesel engine division at Schenectady.

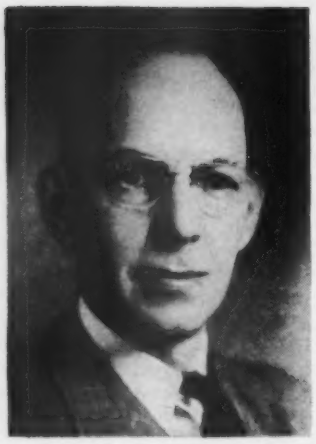
Robert B. McColl, executive vice-president, was educated at Kilmarnock Academy and the Science and Art College, in his native Kilmarnock, Scotland. He began his apprenticeship in locomotive building with the Glasgow & Southwestern railway in Scotland. After a period with Robert Stephenson & Sons in Darlington, England, he joined the Montreal Locomotive Works in Canada, an affiliate of American Locomotive Company. After World War I he was with the Armstrong-Whitworth Company in England but soon returned to America as assistant manager of the Schenectady works of American Locomotive. He since has been successively manager of this plant, president of the company's Diesel engine manufacturing division, the old McIntosh & Seymour Corp., president of the Alco Products division, and vice-president in charge of manufacturing for the company. During the war, he directed the company's huge war production program.



W. L. Lentz

W. L. Lentz, vice-president in charge of manufacturing, took over the management of the Schenectady plant at the outset of the war and supervised the conversion of the plant from its locomotive building operations to tank production. He was an aviation cadet and artillery officer in the last war and began railroading in 1913 with the New York Central. For an interval after 1937, Mr. Lentz was sales manager of the Standard Stoker Company.

John Seagren, chief engineer, Diesel engine division at Schenectady, was in the employ of Fairbanks, Morse & Co. from 1925 to 1932, specializing on Diesel engines and air compressors as a design engineer until he was appointed development engineer in the research and development department. He joined the Atlas Imperial Diesel Engine Company as development engineer in charge of experimental and development work in 1932 and in 1936 was appointed chief engineer in charge of all experimental work and engineering in both the Oakland, Calif., and Matoon, Ill., plants He became development engineer on post-war production for the Northern Pump Company, Minneapolis, Minn., in May, 1944, and in July 1945, became associated with the American Locomotive Company.



John Seagren

◆

MONROE AUTO EQUIPMENT COMPANY.—The Monroe Auto Equipment Company, Monroe, Mich., has announced an expansion of its factories to a point where 454,000 sq. ft. of floor space will be available, more than three times the space available in 1940. Major steps in this expansion include a new plant purchased in Hillsdale, Mich., for the production of truck seats and for molding and compounding rubber, and enlargement of two plants in Monroe.

Donald L. Whitehouse, whose appointment as manager of the Chicago office of the Monroe Auto Equipment Company, Monroe, Mich., was reported in the October issue, was born in Chicago on January 14, 1906. Upon his graduation from Washington University, St. Louis, Mo., in 1933, he went with the Firestone Tire & Rubber Co. in the production control department at Los Angeles, Calif. In 1939 he became sales manager of the Hydro-Gas Company, Winston-Salem, N. C., and in 1940 was appointed assistant manager of the Washington, D. C., office of the Monroe Auto Equipment Company.

Donald L. Whitehouse

◆

FIRTH-STERLING STEEL COMPANY.—*Floyd Rose,* formerly president of Vanadium Alloys Steel Company, has been elected chairman of the board of Firth-Sterling Steel Company, McKeesport, Pa. Mr. Rose had been with Vanadium-Alloys Steel Company since 1926, and prior to that had been vice-president of the Heppenstall Company. According to Mr. Rose, The Firth-Sterling Steel Company plans to add more melting and rolling units to its mill facilities and will expand its research and metallurgical departments.

◆

PANTASOTE COMPANY.—*Frank Geraci,* formerly with the New York Central System, has been appointed manager of the railroad division of the Pantasote Company. Previous to his connection with the New York Central, Mr. Geraci was chief expediter of the Washington, D. C., and Cincinnati, Ohio, offices of the War Department's Transportation Corp., and was with the War Production Board in the transportation equipment division.

Frank Geraci

◆

ELECTRONIC LABORATORIES.—*John W. Cyler* and *F. Theodore Hegeman* have been appointed to the sales department of Electronic Laboratories. Mr. Cyler was head of the order department. Mr. Hegeman will represent Electronic in each of its sales fields.

◆

AMERICAN WELDING & MANUFACTURING COMPANY.—*Raymond H. Gaver* has been appointed chief engineer and *Jonas D. Bigelow* development engineer of the newly established railway equipment division of the American Welding & Manufacturing Company, Warren, Ohio.

Mr. Gaver, who will head the division, has been with the company since 1944, working at research and development on new car and locomotive components. He was born at Columbus, Ohio, and attended Columbus grade schools and Columbus Academy. He later went to Kemper Military Institute and in 1935 received the degree of B.S.M.E. from Purdue University. Upon graduation he joined the

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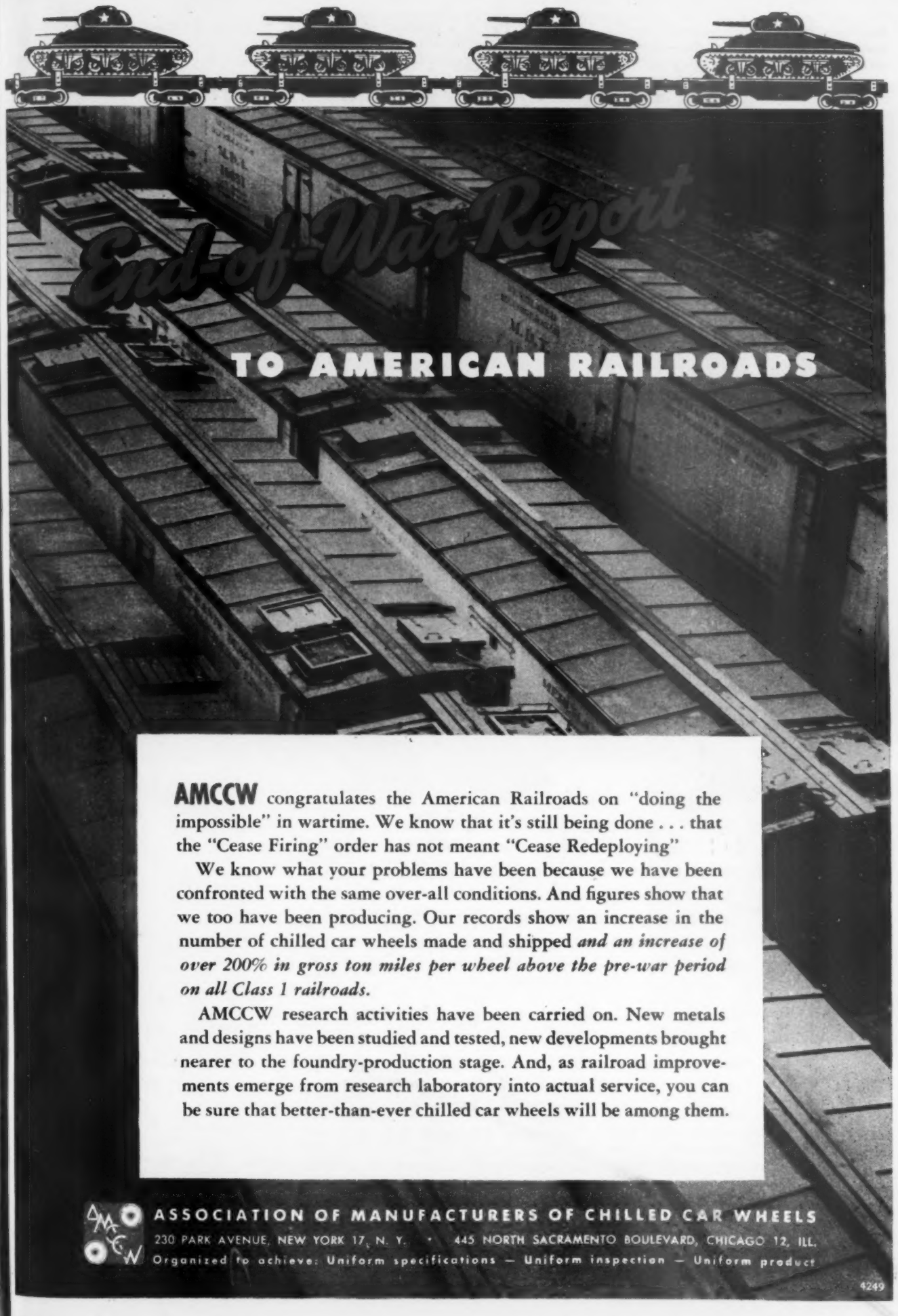

AMCCW congratulates the American Railroads on "doing the impossible" in wartime. We know that it's still being done . . . that the "Cease Firing" order has not meant "Cease Redeploying"

We know what your problems have been because we have been confronted with the same over-all conditions. And figures show that we too have been producing. Our records show an increase in the number of chilled car wheels made and shipped *and an increase of over 200% in gross ton miles per wheel above the pre-war period on all Class 1 railroads.*

AMCCW research activities have been carried on. New metals and designs have been studied and tested, new developments brought nearer to the foundry-production stage. And, as railroad improvements emerge from research laboratory into actual service, you can be sure that better-than-ever chilled car wheels will be among them.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE, NEW YORK 17, N. Y. • 445 NORTH SACRAMENTO BOULEVARD, CHICAGO 12, ILL.

Organized to achieve: Uniform specifications — Uniform inspection — Uniform product

4249

Buckeye Steel Castings Company at Columbus as a service engineer where he worked on railroad equipment, specializing in trucks, couplers and miscellaneous car

Raymond H. Gaver

castings. From 1942 to 1943 he was chief engineer of the Ohio Tubular Products Company.

Mr. Bigelow was born in Jefferson, Ind. He attended private and public schools in that city and also went to Tamalpais Vocational School at Mill Valley, Calif. He began his business career in 1913 as a draftsman in the employ of the American Car and Foundry Company. He later served as a draftsman on the Louisville & Nashville. During 1917-19 he was overseas as an army engineer in World War I. He rejoined the American Car and Foundry Company upon his return to civilian life and in 1922 went into the mechanical engineer's office of the Cleveland, Cincinnati,

J. D. Bigelow

Chicago & St. Louis. In 1931 he became assistant chief draftsman in the employ of the New York Central and from 1942 until he joined American Welding he was special engineer in the office of the general superintendent of motive power and rolling stock.

◆

GENERAL ELECTRIC COMPANY.—*Henry L. Guy*, assistant manager of the transportation divisions at the General Electric Company's Erie, Pa., works, retired August 1, after more than 40 years of service with the company. *F. H. Craton* succeeds Mr. Guy. Mr. Guy is a graduate of Virginia Polytechnic Institute with a degree in electrical engineering (1904). He joined General Electric in Schenectady, N. Y., in 1905, and in 1906 was transferred to what was then the foreign department as an engineering assistant. He entered the commercial branch of the old railway department at Schenectady in 1908, moving to Erie when the transportation department activities were consolidated there. He was appointed assistant manager of the transportation divisions in 1939.

◆

PHILCO CORPORATION.—*Charles F. Greene* has been appointed Atlanta, Ga., representative of the Storage Battery division of the Philco Corporation. Mr. Greene formerly was connected with A. K. Sutton, Inc., Philco distributors in Charlotte, N. C.

◆

FAIRBANKS, MORSE & CO.—*John S. King*, formerly manager of the pump division, has been appointed acting manager of the railroad division of Fairbanks, Morse & Co., to succeed C. H. Wilson, deceased. *Arnold G. Brown*, assistant manager of the

John S. King

pump division, has been appointed to succeed Mr. King as manager of that division.

Mr. King began his career as a student in the Beloit, Wis., plant. He was transferred to the Indianapolis, Ind., plant in 1921 and a year later appointed territorial representative of the Pump department in Chicago. He was appointed Pump department manager of the Chicago branch in 1930. He was appointed manager of the New Orleans, La., branch in 1937 and manager of the Pump division earlier this year.

◆

HARLAN & HOLLINGSWORTH CORPORATION.—*Lewis A. Belding* has been appointed president of the Harlan & Hollingsworth Corporation, Wilmington, Del., to expand the company's post-war activities to include the production of freight cars. Mr. Belding recently completed an engineering assignment with the Henry J. Kaiser Company, which followed 15 years of engineering, designing, and selling of railroad cars for the General American Transportation Corporation of Chicago and an earlier association with the American Car and Foundry Co.

CHICAGO PNEUMATIC TOOL COMPANY.—*Guy J. Coffey* has been appointed vice-president in charge of sales of the Chicago Pneumatic Tool Company, New York. Mr. Coffey was born in Champlain, Ill. He began his career in the employ of the Ohio Steel Foundry Company at Lima, Ohio,

Guy J. Coffey

where he later became chief elecrician. In 1919 he became plant engineer for the Detroit Steel Casting Company and in 1930 resigned to become special sales engineer for the Black & Decker Mfg. Co. He joined the Chicago Pneumatic Tool Company in 1933 as a salesman in the Philadelphia branch. He was later transferred to the Cleveland office and subsequently became manager of the West Coast office.

◆

EDWARD G. BUDD MANUFACTURING COMPANY.—*Joseph F. Clary* has been appointed assistant railroad sales manager of the Edward G. Budd Manufacturing Company,

J. F. Clary

Philadelphia, Pa. Mr. Clary is a graduate of the Massachusetts Institute of Technology (1929) with a B. S. in engineering. Upon graduation he worked as an engineer for the Firestone Tire & Rubber Company, Akron, Ohio. He joined the Budd Company in 1933 as an engineer in the Navy Department. In 1934 he was appointed railroad division engineer, later project engineer and project manager, and in 1940 became mana-

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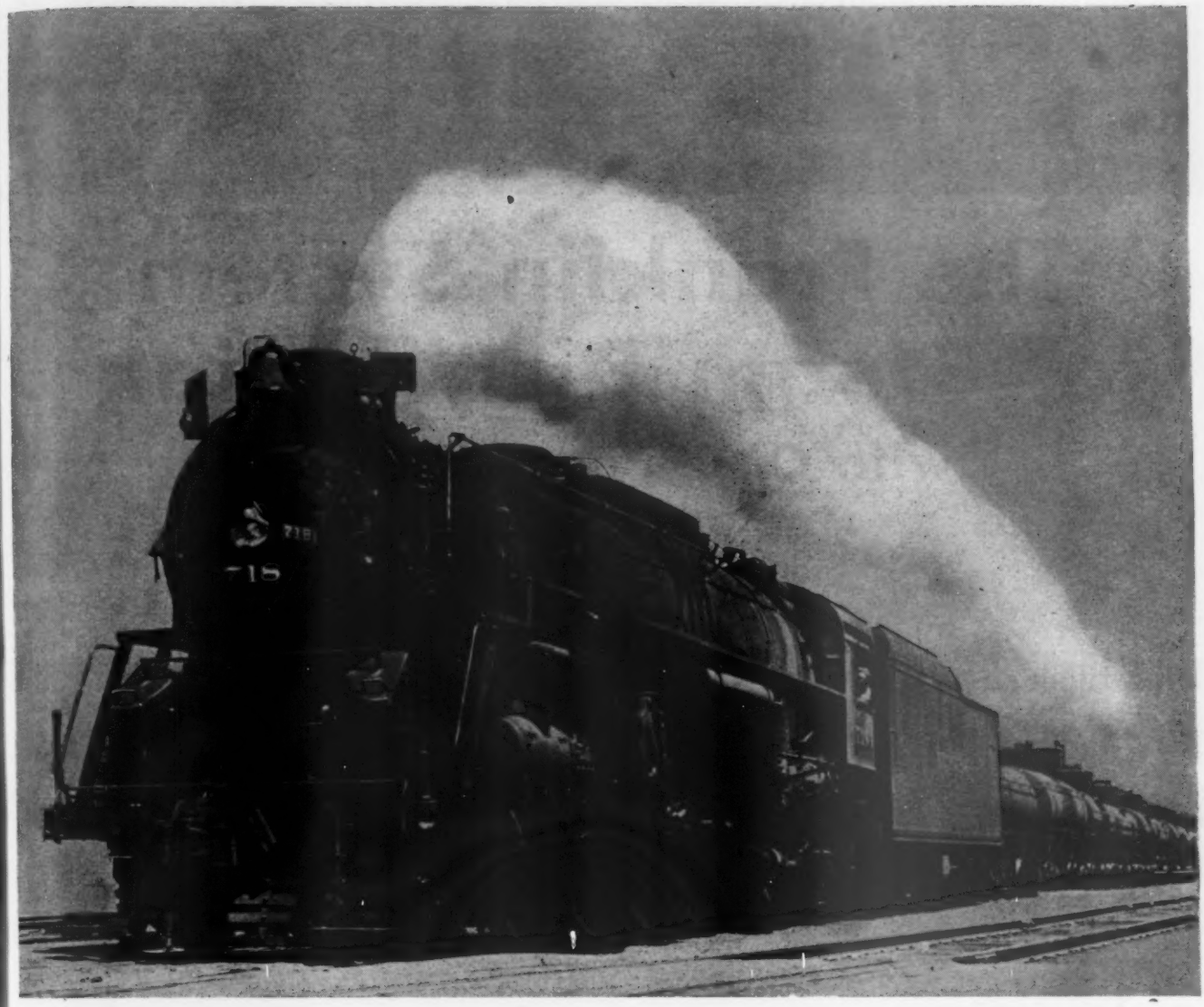


Nickel Plate 2-8-4 built by Lima

Today's Speed will be SLOW tomorrow!

AMERICAN business calls continuously for faster and faster deliveries. To meet this insistent demand, the railroads require motive power capable of hauling heavier trains at higher sustained speeds.

Lima is meeting this need by building steam locomotives that move heavy freight traffic at passenger train speed, with maximum efficiency and economy.

LIMA LOCOMOTIVE WORKS INCORPORATED, LIMA, OHIO

TO SAVE FUEL AND

The Franklin System of Steam Distribution

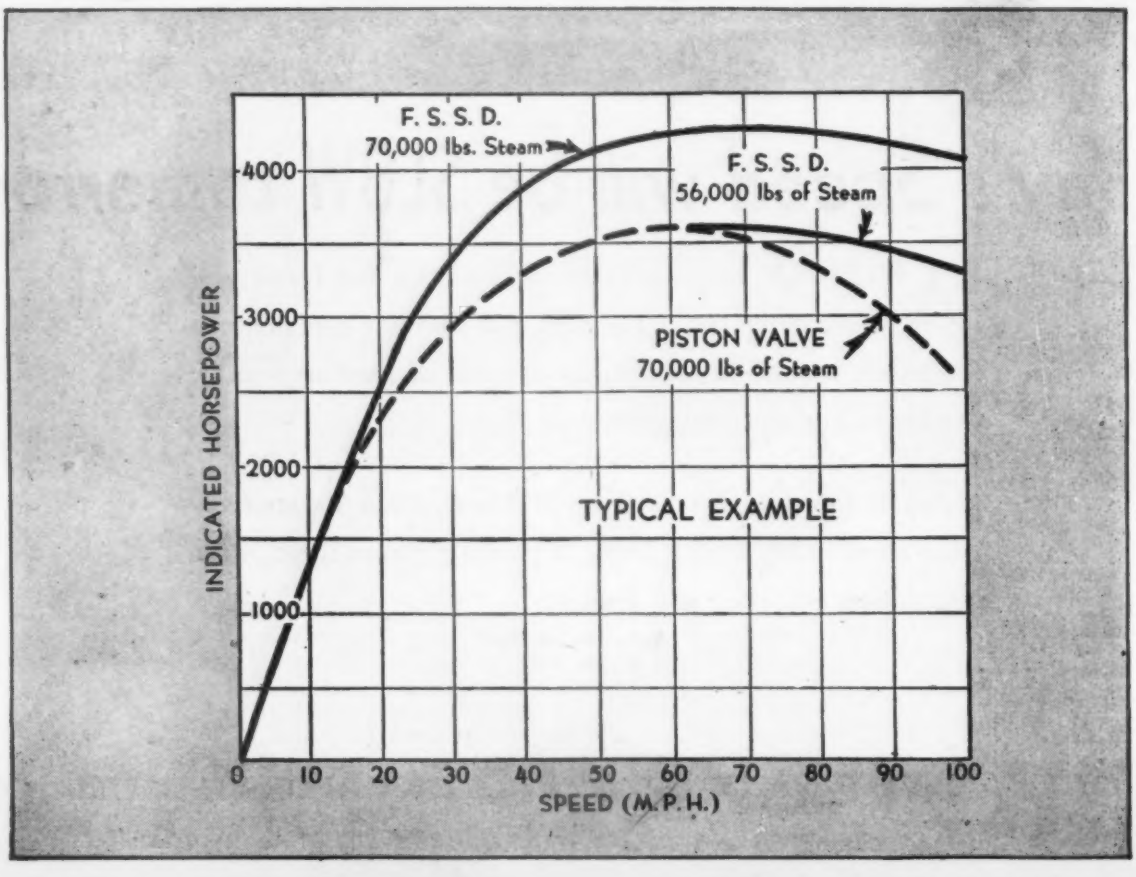
with O. C. Poppet Valves

produces over the Conventional Piston Valve Arrangement

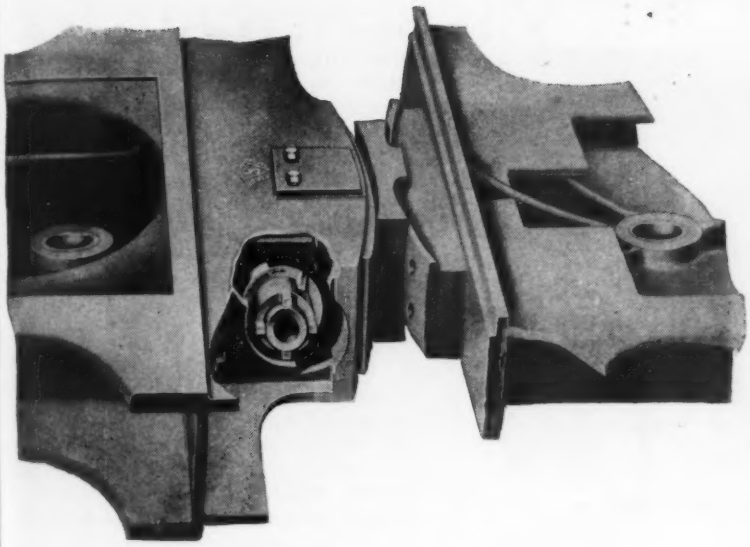
more than 20% Steam Saving
more than 33% Fuel Saving
at same speeds and horsepower

or

with same steam consumption
up to 35%, or more, increase
in Indicated Horsepower



REDUCE MAINTENANCE

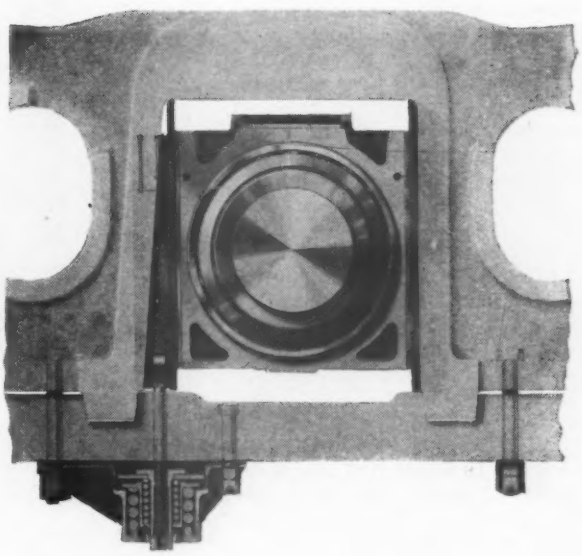


THE FRANKLIN E-2 RADIAL BUFFER

by means of its spherical and cylindrical faces, permits movement in any direction, while maintaining a predetermined frictional resistance to dampen oscillation between engine and tender. By eliminating lost motion, it reduces strains on drawbars and pins, and definitely lessens maintenance on these parts.

THE FRANKLIN COMPENSATOR AND SNUBBER

compensates automatically for expansion and contraction of the driving box, as well as for normal wear. It also dampens the stresses induced by reversal of forces. By preventing pound, it minimizes the wear on all locomotive bearings, with a substantial decrease in maintenance expense.



FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

ger of the railway sales contact division. During the war he worked in the Chemical and Food Process Division of Budd's War Service Department. He later returned to head up the Railroad Sales Contact Division and is now assistant railroad sales manager.

◆

FARNSWORTH TELEVISION & RADIO CORP.—The Farnsworth Television & Radio Corp. has acquired all of the assets of the Halstead Traffic Communications Corporation. Most of the key personnel of the Halstead organization have been added to the Farnsworth staff. *William S. Halstead,* president of the Halstead company, will serve Farnsworth as consulting engineer on radio communications equipment and traffic control as well as on other phases of electronics. *John A. Curtis,* vice-president of Halstead and chairman of its management committee, has been appointed manager of the Farnsworth Communications division. Farnsworth plans to transfer to its Fort Wayne, Ind., plant the Halstead engineering staff as well as that company's laboratory and manufacturing facilities, which heretofore have been in New York.

◆

AIREON MANUFACTURING CORPORATION.—*Jack Kaufman,* head of the new San Francisco, Calif., office of the Aireon Manufacturing Corporation, has been appointed a vice-president. Mr. Kaufman, before becoming associated with the Aireon Corporation, had been engaged for a number of years in electronics in San Francisco. He formerly was president of Heintz & Kaufman, Ltd., and was executive vice-president of Glove Wireless, Ltd.

The Aireon Manufacturing Corporation has purchased all the stock of the Oxford-Tartak Company and the Cineaudagraph Corporation of Chicago. Both companies manufacture radio speakers, microphones and other electronic products.

◆

ARO EQUIPMENT CORPORATION.—The Aro Equipment Corporation, Bryan, Ohio, has announced the appointment of eighteen new jobbers to handle the line of Aro industrial pneumatic tools. These include Rudolf Bass of New York, under the supervision of A. B. Schuhl, local division manager in the territory; the Quality Mills Supply Company, Columbus, Ind., under George W. Gille & Sons, local division managers; the Range Auto Parts, Johnson City, Tenn., under the McEwen Cherry Company, local division managers; the Motor Parts & Equipment Co., LaCrosse, Wis., under J. M. Mase, local division manager; the Morley-Murphy Company, Green Bay, Wis., under C. D. Haven, Jr., local division manager; Equipment Sales and Service and the Washington Machinery & Supply Co., both of Spokane, Wash., under Jack J. Kolberg, company representative; the Casey Tractor & Equipment Co., Portland, Ore., under J. R. Towan, company representative; the T. L. Kuhns Company, Salem, Ore., also under J. R. Towan; the Auto Dealers Supply Company, Los Angeles, Calif., the Craft Shop, San Diego, Calif., under the Burklyn Company local division managers in the territory; the Kendall Hardware-Mill Supply Company, Kalamazoo, Mich., under the supervision of Charles Kocsis, local division manager in the territory; the Reed Process Welding Company, Belleville, Ill., under G. W. Gille & Sons; the Lee Hardware Company, Salina, Kan., under W. L. Etherton; the McFall Auto Works, Globe, Ariz., and Auto Accessories, Inc., Seattle, Wash., under the Burklyn Company; and the San Jose Hardware Company, San Jose, Calif., and Hickenbotham Bros., Ltd., Stockton, Calif., under the H. E. Linney Company.

◆

LANDIS TOOL COMPANY.—*R. F. Ingram,* general sales manager, has been appointed

R. F. Ingram

secretary and vice-president of the Landis Tool Company, Waynesboro, Pa. *W. P. Lotz,* eastern sales manager, succeeds Mr. Ingram as general sales manager.

W. P. Lotz

◇

STANDARD CAR TRUCK COMPANY.—*E. W. Webb,* consulting engineer of the Standard Car Truck Company, Chicago, has retired after 43 years of service.

◆

FEDERAL TELEPHONE & RADIO CORP.—*Norman Wunderlich* has been appointed executive sales director of radio equipment and allied products of the Federal Telephone & Radio Corp., Newark, N. J., manufacturing associate of the International Telephone & Telegraph Corp. Mr. Wunderlich formerly was manager of the communications and electronic division of the Galvin Manufacturing Corporation.

◆

GRAYBAR ELECTRIC COMPANY.—*Harold P. Litchfield,* commercial sales manager, has been appointed assistant general sales manager of the Graybar Electric Company. He will supervise all sales contacts with the General Electric Company, including its lamp division, and have charge of Graybar sales in lighting, lamps, power apparatus, marine and signaling.

◆

GENERAL MOTORS CORPORATION.—*Colonel Frederick C. Horner,* formerly assistant to the chairman of the General Motors Corporation on transportation matters, who is now on inactive status in the U. S. Army, is returning to the corporation as director of the field operations sections of the distribution staff, with headquarters in Detroit, Mich.

◆

CARNEGIE-ILLINOIS STEEL CORPORATION.—*Thomas J. Hilliard,* general manager of sales, has been elected vice-president in charge of sales of the Carnegie-Illinois Steel Corporation, U. S. Steel subsidiary. *J. Douglas Darby,* manager of sales in Philadelphia, Pa., succeeded Mr. Hilliard as general manager of sales. *Wesley C. Bobbitt,* assistant manager of sales, has been appointed manager of sales in Philadelphia, and *A. Paul Selby,* assistant to the general manager of sales, has been appointed assistant general manager of sales.

◆

BOWSER, INC.—*Daniel P. Morgan* has been appointed to the railroad sales engineering staff of Bowser, Inc., Fort Wayne, Ind., with headquarters in Washington, D. C. Mr. Morgan, who will cover the southeast railroad division, formerly was assistant district sales manager in the Philadelphia, Pa., office of the Pittsburgh Steel Foundry Corporation. Prior thereto he was a special railway representative of the Hanna Stoker Company.

◆

AMERICAN ARCH COMPANY.—*Arthur F. Becker,* for the past twelve years assistant to the vice-president of the American Arch Company at Chicago, has been transferred as vice-president to the company's New York office. *Charles Ringel,* formerly with the American Locomotive Company, has joined the engineering department of the American Arch Company.

◆

PEERLESS MACHINE COMPANY.—*James E. Thoms,* sales manager of the Peerless Machine Company, Racine, Wis., has been appointed vice-president in charge of sales and general administration.

◆

AMERICAN STEEL & WIRE COMPANY.—*H. A. Squibbs,* assistant general manager of sales of the American Steel & Wire Co. (a subsidiary of the United States Steel Corporation) at Chicago, has been appointed assistant to the vice-president in charge of sales, with headquarters at Chicago. C. T. Gilchrist, manager of the manufacturers products sales division, has been advanced

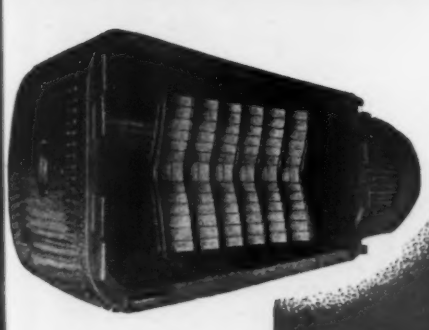
(Continued on next left-hand page)

Eating up the miles... economically

● On the heavy haul and the long run, Security Circulators definitely improve locomotive performance.

In addition to improving the circulation of water over the crown sheet and in the side water-legs, Security Circulators reduce honeycombing, flue plugging and cinder cutting.

Security Circulators permit the use of a 100% arch, prolong the life of arch brick, and also act as struts or stays, bracing the firebox against undue distortion.



AMERICAN ARCH COMPANY, INC.

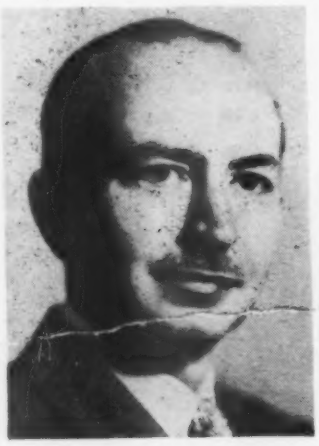
NEW YORK · CHICAGO

SECURITY CIRCULATOR DIVISION

to assistant general manager of sales, succeeding Mr. Squibbs, with headquarters as before at Chicago. *John Graham* has been appointed general manager of sales; *R. F. Curtis,* formerly assistant manager of the manufacturers products division, has been appointed manager of that division to succeed Mr. Graham and *Norman Reed,* formerly in Cleveland, Ohio, district sales, has been appointed assistant manager under Mr. Curtis. *C. N. Schmidt* has been appointed advertising manager to succeed *Wilmer H. Cordes,* who now will devote his full attention to his responsibilities as manager of sales research, development and promotion.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*G. A. England* has been appointed manager of foundry sales of the American Car and Foundry Company with headquarters in New York. Mr. England attended Missouri University where he specialized in chemical engineering. He joined American Car and Foundry in January, 1923, as assistant chemist in the St. Louis, Mo., foundry and from 1925 to 1935 was employed as chief chemist and in research for foundry products of gray iron castings and chilled car wheels. In 1935 he was appointed assistant to the manager of foundries, assisting in sales and the production of castings and wheels for all of the company's foundries. He was transferred to New York as sales agent in November, 1944.



G. A. England

◆

PROGRESSIVE WELDER COMPANY.—*P. D. DeLeo* has been appointed development engineer; *I. A. Crawford,* research engineer, and *E. Y. Bunting,* machine design engineer of the Progressive Welder Company, Detroit, Mich.

◆

FRANKLIN RAILWAY SUPPLY COMPANY.—*Julius Kirchhof* has been elected vice-president in charge of engineering for the Franklin Railway Supply Company, with headquarters in New York.

◆

AMERICAN SMELTING & REFINING COMPANY.—*Aubrey M. Callis* has been appointed sales manager of the Whiting, Ind., and Detroit, Mich., plants of the Federated Metals division of the American Smelting & Refining Co. Mr. Callis, formerly assistant general manager of the Pacific Coast department with headquarters at Los Angeles, Calif., has been associated with Federated since 1928 in sales and plant executive capacities.

◆

AMERICAN ROLLING MILL COMPANY; RUSTLESS IRON & STEEL CORPORATION.—*Charles R. Hook,* president of the American Rolling Mill Company and chairman of the board of the Rustless Iron & Steel Corp., has announced that the boards of the two corporations have authorized the preparation of an agreement providing for the merger of Rustless into American Rolling Mill, subject to stockholders' approval. After the merger, to become effective at the year-end, the Rustless plant at Baltimore, Md., will be operated as the Rustless Iron & Steel division.

◆

BETHLEHEM STEEL COMPANY.—*Walter R. Penman,* assistant general manager, has been appointed general manager of the Lebanon, Pa., plant of the Bethlehem Steel Company to succeed *J. H. Edmonds,* who has retired.

◆

SCULLIN STEEL COMPANY.—*B. W. Crenshaw* has been appointed sales representative of the Scullin Steel Company with headquarters in St. Louis, Mo. Mr. Crenshaw has been connected with Scullin Steel since 1941 as works engineer and as assistant works manager.

◆

BAKER-RAULANG COMPANY.—*Lt. Col. H. A. Stevenson,* general staff corps, Army Service Forces, was retired to inactive duty on August 1, and has returned to his former business—the distribution in the Michigan territory of industrial trucks, tractors and cranes of the Baker Industrial Truck Division of the Baker-Raulang Company, Cleveland, Ohio.

◆

UNITED STATES STEEL CORPORATION.—*David F. Austin,* vice-president in charge of sales of the Carnegie-Illinois Steel Corp., and acting vice-president of the United States Steel Corp., has been elected vice-president of sales of the latter company, with headquarters as before at Pittsburgh, Pa.

◆

WEATHERHEAD COMPANY.—*Leonard C. Doolittle* has been appointed industrial hose sales engineer of the Weatherhead Company of Cleveland, Ohio. Major Doolittle recently returned from three years of service in the U. S. Air Corps. Before entering military service he was division sales manager of the Gates Rubber Company at Denver, Colo.

◆

ALLEGHENY-LUDLUM STEEL CORPORATION.—A $5,000,000 postwar research and production expansion program has been approved by the board of the Allegheny-Ludlum Steel Corporation. A research laboratory and related experimental and pilot plant equipment will be built at the company's headquarters, Brackenridge, Pa., and a cold rolling mill will be constructed at the West Leachburg, Pa., plant.

ARDCO MANUFACTURING COMPANY.—*Robert D. Fleischer* has been appointed general sales manager for southern territories in the Ardco Manufacturing Company's newly organized branch, with headquarters at Richmond, Va. Mr. Fleischer served in various capacities with several New York advertising firms and as sales manager for several engineering firms before being appointed to his present position.

◆

AMERICAN BRAKE SHOE COMPANY.—*John S. Hutchins* has been elected president of the Ramapo Ajax Division of the American Brake Shoe Company. Mr. Hutchins began his career with Ramapo Ajax in the operating department in 1925. He was appointed sales manager in 1941 and executive vice-president in October, 1944. J. Brooks Spencer, president of the division since 1936, is a vice-president of the Brake Shoe Company. He will handle special assignments in connection with railroad sales for all divisions in addition to his present responsibilities as officer in charge of the company's export division. Headquarters of the Ramapo Ajax division will be transferred from New York to 332 South Michigan Avenue, Chicago.

John S. Hutchins

◆

STANDARD OIL COMPANY OF INDIANA.—Construction has begun on an administration building, general laboratories, and three pilot-plant buildings on recently acquired property in Hammond, Ind. These units will constitute part of new research laboratories which, when completed, will consist of an engine laboratory, a greenhouse for insecticide work, additional pilot-plant buildings, and other research facilities.

◆

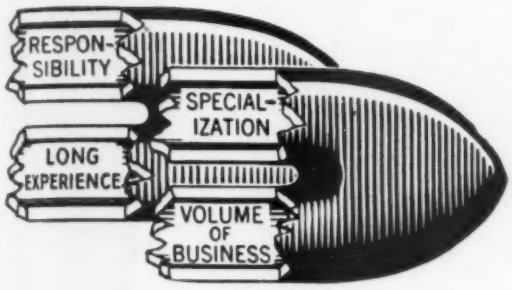
WHITCOMB LOCOMOTIVE COMPANY.—*R. O. Nash,* who has been connected with the Whitcomb Locomotive Company since last July, has been appointed St. Louis district manager in charge of sales and service, with headquarters at St. Louis, Mo. Mr. Nash is a graduate of the University of Minnesota. He began his career with the General Electric Company at Erie, Pa., later serving for a brief period as a special apprentice in the mechanical department of the Chicago, Milwaukee, St. Paul & Pacific. In 1927 he was appointed a railway equipment

(Continued on second left-hand page)

The Approach to a

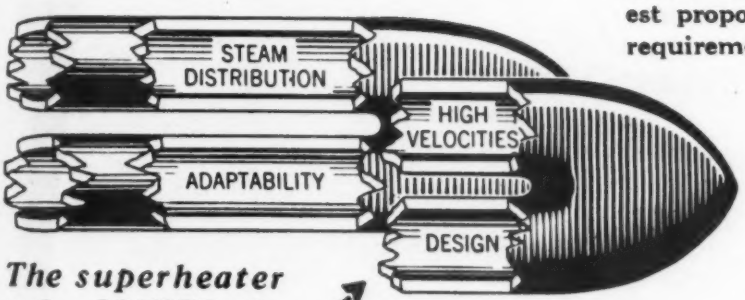
SUPERHEATER SPECIFICATION

Specialization



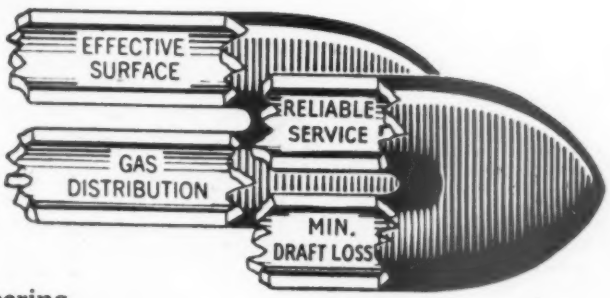
Organizations who do specialized work are leaders only when the specialization is of long standing and has wide acceptance.

It is fitting to state that the organization behind Elesco superheaters and its affiliates have specialized in superheaters for over thirty years. But this in itself is not nearly as important as the fact that in this specialization it is serving by far the greatest proportion of the world's superheater requirements.



The superheater tube MAKES the RETURN BEND

The RETURN BEND MAKES the Elesco superheater



In addition to the specialized engineering and experience behind Elesco in America—you have the added advantage of supplementing them with the research, practical experience and developments of Elesco affiliates in other countries.

Super-specialization might be a more appropriate term applying to this specialized service—Be sure to use it.

THAT'S ELESCO

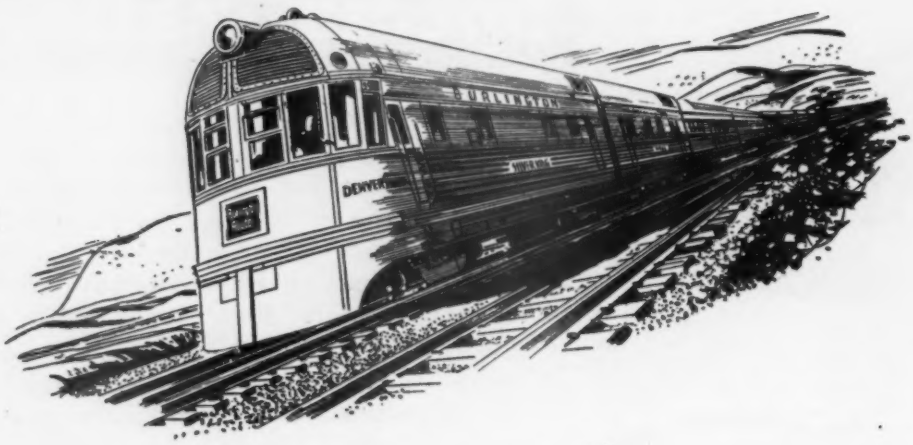
A-149

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Blvd., CHICAGO
• • •
Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

IT'S A GREAT NEW DAY FOR RAILROADING



Out of the 48 super-rapid
start-to-stop runs analyzed*
35 were GM-powered.
The fastest run was between
East Dubuque and Prairie du Chien,
(Burlington's *Morning Zephyr*),
54.6 miles at an
84-mile-an-hour average.

Speed isn't everything —
nor is it everything a
GM Diesel delivers —
but it certainly shows
which way the wind blows!

GENERAL MOTORS
LOCOMOTIVES

IT'S A GREAT NEW DAY FOR RAILROADING

*General Motors
Diesel locomotives
powered 9 of the
fastest start-to-stop
schedules run by
streamlined trains
in the United States
in 1944!

At average speeds of 76.4 to
84 miles per hour!

* According to a table published
recently by the Railway Gazette,
leading English railway trade paper.

ADD SECURITY TO VICTORY ★ BUY *MORE* VICTORY BONDS

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION • LA GRANGE, ILL.

engineer of the Westinghouse Electric & Manufacturing Co., with headquarters at East Pittsburgh, Pa. Three years later he became resident engineer of the company's South Philadelphia plant, also serving as field engineer. In 1936 Mr. Nash was appointed industrial and transportation sales representative at St. Louis, and in 1940, supervisor of maintenance sales at St. Louis. In 1942 he became a special representative in the railroad division of the Socony-Vacuum Oil Company, the position he relinquished to become associated with the Whitcomb organization.

◆

PHILCO CORPORATION.—*R. D. Birge* has been appointed Detroit, Mich., representative of the Philco Storage Battery division of the Philco Corporation. Mr. Birge is a graduate of Purdue University with a degree in electrical engineering (1938). He has been associated with the Louis Allis Company as field engineer in Detroit for three years and more recently in Philadelphia, Pa., for one year.

◆

INLAND STEEL COMPANY.—*William H. Eichengreen,* assistant manager of the sales promotion division of the Inland Steel Company, has been promoted to manager of the commercial research division which has been created as a new division of the firm's sales department. His headquarters will be in Chicago. Mr. Eichengreen joined Inland Steel in 1931 and spent several years in the company's pricing and sales promotion divisions.

◆

SUPERHEATER COMPANY.—*Walter P. Sebastian,* engine terminal foreman of the Southern railway at Spencer, N. C., has been appointed service engineer of the Superheater Company in the southeast, with headquarters at New York.

◆

SCHAEFER EQUIPMENT COMPANY.—*A. Perry Everstine* has been appointed manager of the Schaefer Equipment Company with headquarters in the company's general offices, Pittsburgh, Pa. *C. W. Wright, Jr.,* has been appointed assistant manager in charge of customer relations in respect to inquiries and orders, also with headquarters at Pittsburgh.

Obituary

ALBERT LINCOLN SALT, retired president and chairman of the board of the Graybar Electric Company, died September 29. He was 80 years of age.

◆

CHARLES H. WILSON, manager of the railroad sales division of Fairbanks, Morse & Co., whose death in Chicago on September 13, was reported in the October issue, was born in Salem, Mass., on May 27, 1884, and attended the Armour Institute of Technology. He entered the sales department of Fairbanks, Morse in 1905, at Chicago. In 1910 he was transferred to Jacksonville, Fla., remaining there until 1911, when he returned to Chicago as a member of the staff of the purchasing department. The following year he went with the International Harvester Company handling sales in northern Illinois. He returned to Fairbanks, Morse in 1913, in the railway sales department, at St. Louis, Mo.; in 1922 was transferred to Chicago, and in 1929 became district manager of railroad sales at St. Louis. Mr. Wilson was appointed manager of railroad sales, with headquarters at Chicago in 1932.

Charles H. Wilson

Personal Mention

General

O. R. BAREFOOT, whose appointment as assistant superintendent motive power, Eastern lines, of the Canadian Pacific at Toronto, Ont., was announced in the October issue, entered the employ of the Canadian Pacific in 1909 as a night foreman at North Bay, Ont. He subsequently served in various capacities at Lambton, Ont., the St. John shops, and at McAdam, N. B., and in 1942 became master mechanic of the Bruce division at Toronto.

O. R. Barefoot

W. P. SULLIVAN has been appointed acting supervisor of Diesel equipment of the Missouri Pacific, with headquarters at St. Louis, Mo.

W. B. BERRY, assistant superintendent of motive power of the St. Louis-San Francisco at Springfield, Mo., has been appointed superintendent of motive power, with headquarters at Springfield. Mr. Berry was born at St. Louis, Mo., on December 13, 1881, and began his railway career as a machinist apprentice in the employ of the Texas & Pacific at Marshall, Tex. He later became a machinist and subsequently served in various capacities ranging from machinist to enginehouse foreman and general foreman on the Missouri Pacific, the Chicago, Rock Island & Pacific, the Missouri-Kansas-Texas, the Southern Pacific, the Trinity & Brazos Valley (now a part of the Chicago, Burlington & Quincy), and the Atchison, Topeka & Santa Fe. In May, 1922, Mr. Berry was appointed master mechanic of the Frisco, with headquarters at Kansas City, Mo., and on August 10, 1935, became assistant superintendent of motive power.

J. D. LOFTIS has been appointed general superintendent motive power of the Atlantic Coast Line, with headquarters at Wilmington, N. C. Mr. Loftis was educated at Utah University and Leland Stanford University. He entered railroading in 1928 with the Denver & Rio Grande Western and remained with that railroad until August, 1942, when he joined the Office of

J. D. Loftis

Defense Transportation, where he served as mechanical assistant, assistant to the director, division of railway transport, and as traffic flow chief, until December, 1943. He then joined the Baldwin Locomotive Works at Cleveland, Ohio, and in August, 1944, became eastern district manager in charge of a new office opened by that company in Philadelphia, Pa. Notice of his recent change of position came on September 29, 1945.

R. H. ROMANN has been appointed acting superintendent of motive power and equipment of the Peoria & Pekin Union, with headquarters at Peoria, Ill., succeeding E. A. Park, who is on leave.

IVAN R. PEASE, assistant superintendent of motive power of the New York, Ontario & Western at Middletown, N. Y., has been appointed superintendent of motive power with headquarters at Middletown. Mr. Pease was born on July 7, 1898, at Wilton, Me. Mr. Pease attended the University of Maine and entered railroading in 1924 as a special apprentice in the employ of the New York, New Haven & Hartford. He subsequently served in the New Haven locomotive shops as gas engine mechanic, foreman of the gas rail car department, and production assistant. From 1931 to 1934 he served with the New England Transportation Company (subsidiary of the New Ha-

Ivan R. Pease

ven) and from 1934 to 1937 with the Universal Motor Mileage Corporation at Boston, Mass. In 1937 he became test supervisor of the New Haven and in 1941 supervisor of apprentices. Later in 1941 Mr. Pease was appointed assistant to superintendent motive power of the N. Y., O. & W. and in 1942 assistant superintendent motive power of the N. Y., O. & W. and the New York, Susquehanna & Western.

THOMAS H. EVANS, shop superintendent of the Missouri-Kansas-Texas at Waco, Tex., has been appointed chief mechanical officer, with headquarters at Parsons, Kan.

F. E. RUSSELL, chief mechanical engineer of the Southern Pacific, with headquarters at San Francisco, Cal., has retired after 46 years of service.

V. J. CROSSLEY, master mechanic of the Bamberger Railroad, has been appointed to fill the newly created position of train master at Salt Lake City, Utah.

L. A. PORTER, assistant general superintendent motive power of the Seaboard Air Line, has been appointed to the newly-created position of chief mechanical officer with headquarters as before at Norfolk, Va. Mr. Porter was born on October 17, 1899, in Culpeper County, Va. He is a graduate of Virginia Polytechnic Institute

L. A. Porter

(1910) and attended the University of Edinburgh in 1919. He began his career in August, 1910, as a clerk and draftsman in the employ of the Seaboard Air Line, then worked successively, from 1912 until 1916, for the United States Steel Corporation and the Richmond Cedar Works. He returned to the Seaboard Air Line in 1916 as a draftsman. During World War I Mr. Porter was a captain in the United States Army serving with the American Expeditionary Forces. From 1919 until 1922 he was employed at the U. S. Navy Yard, Norfolk, Va. In the latter year he again returned to the Seaboard Air Line as a draftsman. In 1926 he became chief draftsman, in 1936, mechanical engineer, in 1942, assistant to the general superintendent motive power, and in 1944 to assistant general superintendent motive power.

S. D. DEKLE, assistant general superintendent motive power of the Seaboard Air Line, has been appointed assistant chief mechanical officer with system jurisdiction, with headquarters as before at Jacksonville, Fla.

GEORGE FERGUSON, air-brake instructor, Central region, of the Pennsylvania, has been appointed general air brake inspector, Central region, with headquarters at Pittsburgh, Pa.

OTTO C. GRUENBERG has returned to his position as superintendent of motive power of the New York, Susquehanna & Western. Mr. Gruenberg, holding the rank of major, had been serving as a transportation officer in the United States Army for the past three years.

W. G. MCPHERSON, whose retirement as assistant superintendent motive power, Eastern lines, of the Canadian Pacific at Toronto, Ont., was announced in the October issue, entered railroading with the Canadian Pacific on November 13, 1901, as a fitter at Revelstoke, B. C. He subsequently served at Cranbrook, B. C., and Calgary, Alta., until February 21, 1910, when he became locomotive foreman at Hardisty, Alta. After being located at several points in western territory, he was appointed district master mechanic at North Bay, Ont., on January 1, 1929. On June 1, 1935, he was appointed assistant superintendent motive power, at Montreal, Que., and in May, 1937, was transferred to Toronto.

W. H. GIMSON, master mechanic of the St. Louis-San Francisco at Tulsa, Okla., has been appointed assistant superintendent of motive power, with headquarters at Springfield, Mo. Mr. Gimson was born at Memphis, Tenn., on September 13, 1887, and entered railway service with the Frisco as a machinist apprentice in September, 1904, at Memphis. Later he served as enginehouse foreman at Memphis and on March 1, 1917, was appointed division foreman, with headquarters at Harvard, Ark. Later in the same year Mr. Gimson became general foreman at Monett, Mo. On August 15, 1929, he was appointed shop superintendent at Tulsa, Okla., and on January 1, 1941, he became master mechanic at Tulsa.

HENRY W. JARRETT, master mechanic of the Seaboard Air Line at Savannah, Ga., has been appointed assistant to chief mechanical officer, with headquarters at Norfolk, Va.

Master Mechanics and Road Foremen

W. P. PRIMM has been appointed road foreman of engines of the Pennsylvania, with headquarters at Toledo, Ohio.

RICHARD F. BENTON has been appointed master mechanic of the Bamberger Railroad, with headquarters at North Salt Lake City, Utah.

L. M. WINSLADE, locomotive foreman in the employ of the Canadian Pacific at Lambton, Ont., has been appointed division master mechanic, Montreal Terminals division with headquarters at Montreal, Que.

W. C. FLECK has been appointed assistant master mechanic of the Ft. Wayne division of the Pennsylvania, with headquarters at Ft. Wayne, Ind.

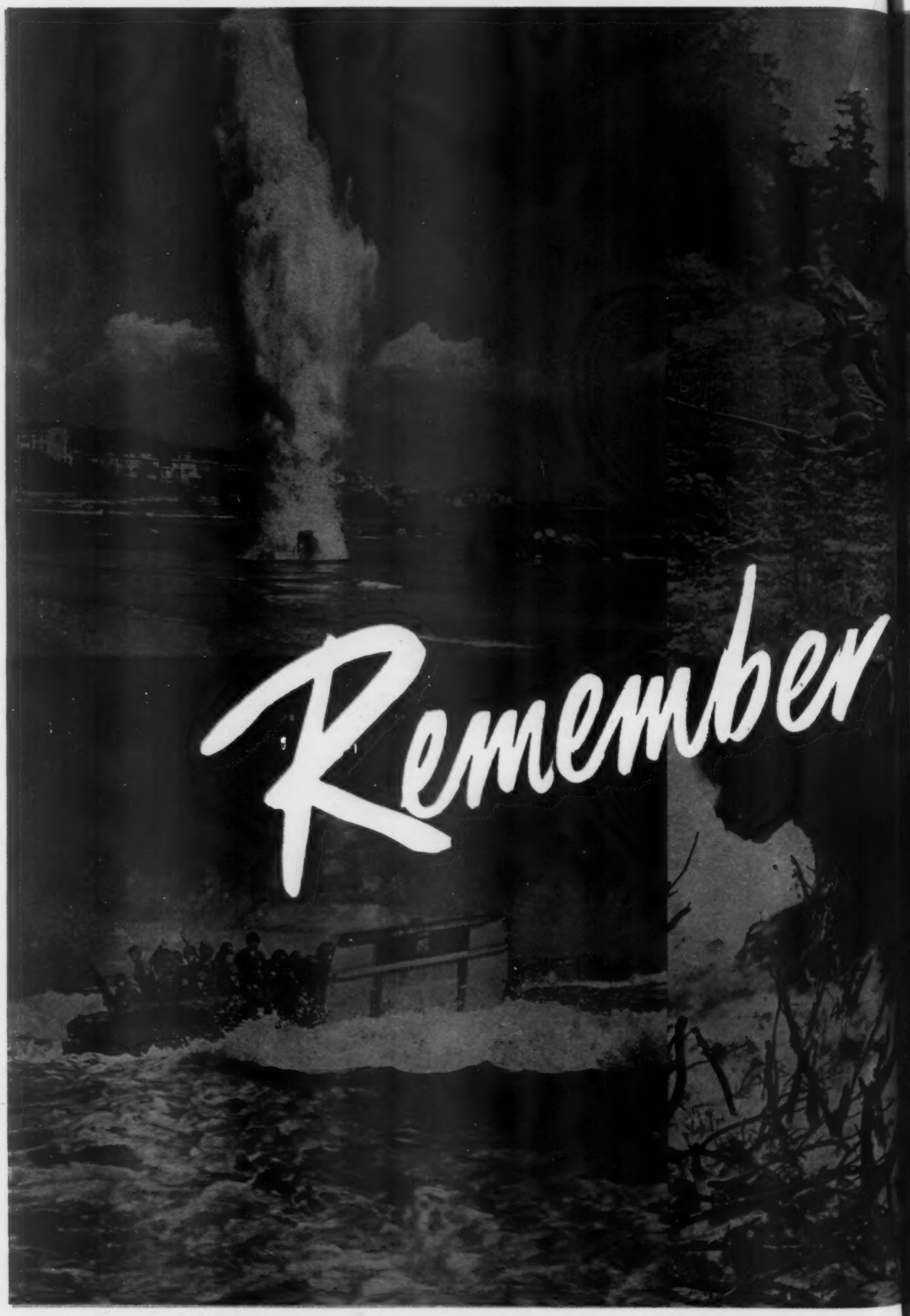
D. J. EVERETT, master mechanic of the Gulf division of the Gulf, Colorado & Santa Fe at Galveston, Tex., has been transferred to the Southern division, with headquarters at Temple, Tex.

F. M. MOZLEY, master mechanic of the Southern division of the Gulf, Colorado & Santa Fe at Temple, Tex., has been transferred to the Gulf division, with headquarters at Galveston, Tex.

J. H. BURGER, assistant master mechanic of the Illinois Central at Markham, Ill., has been appointed master mechanic, with headquarters at Champaign, Ill.

THOMAS MURRAY, general foreman of the St. Louis San Francisco at North Springfield, Mo., has been appointed master mechanic with headquarters at Tulsa, Okla.

(Turn to second left-hand page)


Remember

Kasserine Pass, Anzio, Saint-Lô, the Remagen Bridge...

Guadalcanal, Attu, Bougainville, Tarawa, Iwo, Okinawa...

Remember?

Already, the names grow a little hazy to some of us. But men died there, and more were hurt, and some managed to come through.

They had a tough job to do...and they did it. *You* remember.

There's something called a debt we owe... to several million men who finished the biggest job this country ever tackled...

A debt to men who fought and were wounded—and still need the best medical attention in the world. To men who are scattered all over the globe—and still need return-trip tickets. To men who are coming out of uniform—and need a hand to get started again.

You can help pay our debt to these men—by buying Victory Bonds. Bonds—not to give them weapons this time, but to give them back their world. That's the job *you're* asked to finish—by buying extra bonds for the last time.

Kasserine Pass... Anzio... Okinawa...

How good is your memory?

Victory Loan

They Finished Their Job
Let's Finish Ours!

CONTRIBUTED BY
AMERICAN LOCOMOTIVE COMPANY

P. H. VERD has been appointed master mechanic of the Gary division of the Elgin Joliet & Eastern, with headquarters at Gary, Ind.

P. J. JOHNSON, division master mechanic of the Canadian Pacific at Montreal, Que., has been appointed district master mechanic, with headquarters at Montreal.

Electrical

F. W. REED, electrical engineer of the Northern Pacific at St. Paul, Minn., has retired.

R. C. SORENSON has been appointed electrical engineer of the Northern Pacific, with headquarters at St. Paul, Minn.

EARL C. MASON, recently released from the Army in which he served as captain, Transportation Corps, has been appointed assistant superintendent electrical equipment department, New York Central, with headquarters at Harmon, N. Y.

Car Department

A. H. FAERBER, superintendent of shop of the New York Central at East Buffalo, N. Y., has retired after more than 40 years of service.

C. N. KITTLE, division general car foreman of the New York Central at Buffalo, N. Y., has been appointed superintendent of shop at East Buffalo, N. Y.

Shop and Enginehouse

JOHN B. REESE, general shop foreman of the Missouri-Kansas-Texas at Waco, Tex., has been appointed shop superintendent at Waco.

A. C. STACKMAN, gang foreman at the Pitcairn, Pa., enginehouse of the Pennsylvania, has been appointed enginehouse foreman at Shire Oaks, Pa., Monongahela division.

Obituary

FRANK W. THOMAS, retired supervisor of apprentices of the Atchison, Topeka & Santa Fe, died in Topeka, Kan., on September 13, 1945, as noted in the October issue. Interment took place at Roanoke, Va. In 1907, when the Santa Fe decided to enlarge and extend its apprentice training facilities, Mr. Thomas, then engineer of tests, was made supervisor of apprentices. Within the next few years a training system was developed which achieved a wide reputation for its thoroughness and high standards. Not only did it supply well-trained craftsmen, but it was the training ground of many of the present mechanical officers of the Santa Fe. Mr. Thomas retired in 1932.

F. G. LISTER, superintendent of motive power of the St. Louis-San Francisco, with headquarters at Springfield, Mo., died in a Tulsa, Okla., hospital on August 20. Mr. Lister was born at Marysville, Kan., on July 8, 1882, and studied for two years at the University of Nebraska. His first railway service was with the Wabash in 1901, as a special apprentice, becoming a mechanical draftsman a short time later. In 1906, Mr. Lister went with the Northern Pacific as a locomotive and car draftsman, and five years later became chief draftsman and mechanical engineer of the Spokane, Portland & Seattle and affiliated lines. In 1916 he became mechanical engineer of the El Paso & Southwestern (now part of the Southern Pacific); in 1924, master car repairer on the Southern Pacific, at El Paso, Tex., and in 1926 chief mechanical officer of the St. Louis-San Francisco. On January 1, 1931, he was appointed assistant superintedent of motive power, and two years later superintendent of motive power.

ALBERT J. KRUEGER, general superintendent car department of the New York, Chicago & St. Louis at Cleveland, Ohio, died suddenly on October 13. Mr. Krueger was born in Toledo, Ohio, on June 26, 1890. He began his railroad career in 1912, serving successively in the employ of the Lake Shore & Michigan Southern (now New York Central) as clerk and car repairman at Air Line Junction, Ohio; inspector at Erie, Pa., and piecework inspector at Air Line Junction. In 1913 he became contract inspector for the Michigan Central at Chicago Heights, Ill., and in 1914 assistant general shop inspector of the Lake Shore & Michigan Southern at Collinwood, Ohio, and Englewood, Ill. He entered the employ of the New York, Chicago & St. Louis in 1916 as general shop inspector at Cleveland, and in 1921 was appointed master car builder with headquarters at Cleveland. From 1933 to 1937 he was general car foreman at Conneaut, Ohio. In the latter year he became inspector car department of the Chesapeake & Ohio, Pere Marquette, and the New York, Chicago & St. Louis at Cleveland. He was appointed superintendent of the car department of the New York, Chicago & St. Louis at Cleveland in January, 1938, and general superintendent car department in 1943. Mr. Krueger had been active in the work of the Car Department Officers' Association for many years. In 1941 he was elected president of the association and in 1942 again took over and had since continued the duties of president, acting for F. E. Cheshire, who had entered military service. He was also a member of the Western Railway Club, the Central Railway Club, and the Car Department Association of St. Louis.

A. J. Krueger

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers, preferably on company letterhead, giving title. State the name and number of the bulletin or catalog desired, when it is mentioned.

VERTICAL TURRET MILLS.—Rogers Machine Works, Inc., 1807 Elmwood avenue, Buffalo 7, N. Y. 12-page illustrated booklet describing the Rogers "Perfect 36" vertical turret mills for boring, drilling, and turning.

◆

FASTENING DEVICES.— Parker-Kalon Corporation, 208 Varick Street, New York 14. Sixth edition of Parker-Kalon catalog contains new information on their many types of self-tapping screws, socket screws, and other fastening devices, with illustrated instructions on where and how to use.

◆

PALMETTO PACKINGS.—Greene, Tweed & Co., Bronx boulevard at Two Hundred and Thirty-eighth street, New York 66. Bulletin P-3 contains condensed descriptions of each grade of Palmetto packing, with illustrations and an application chart for self-lubricating packings.

◆

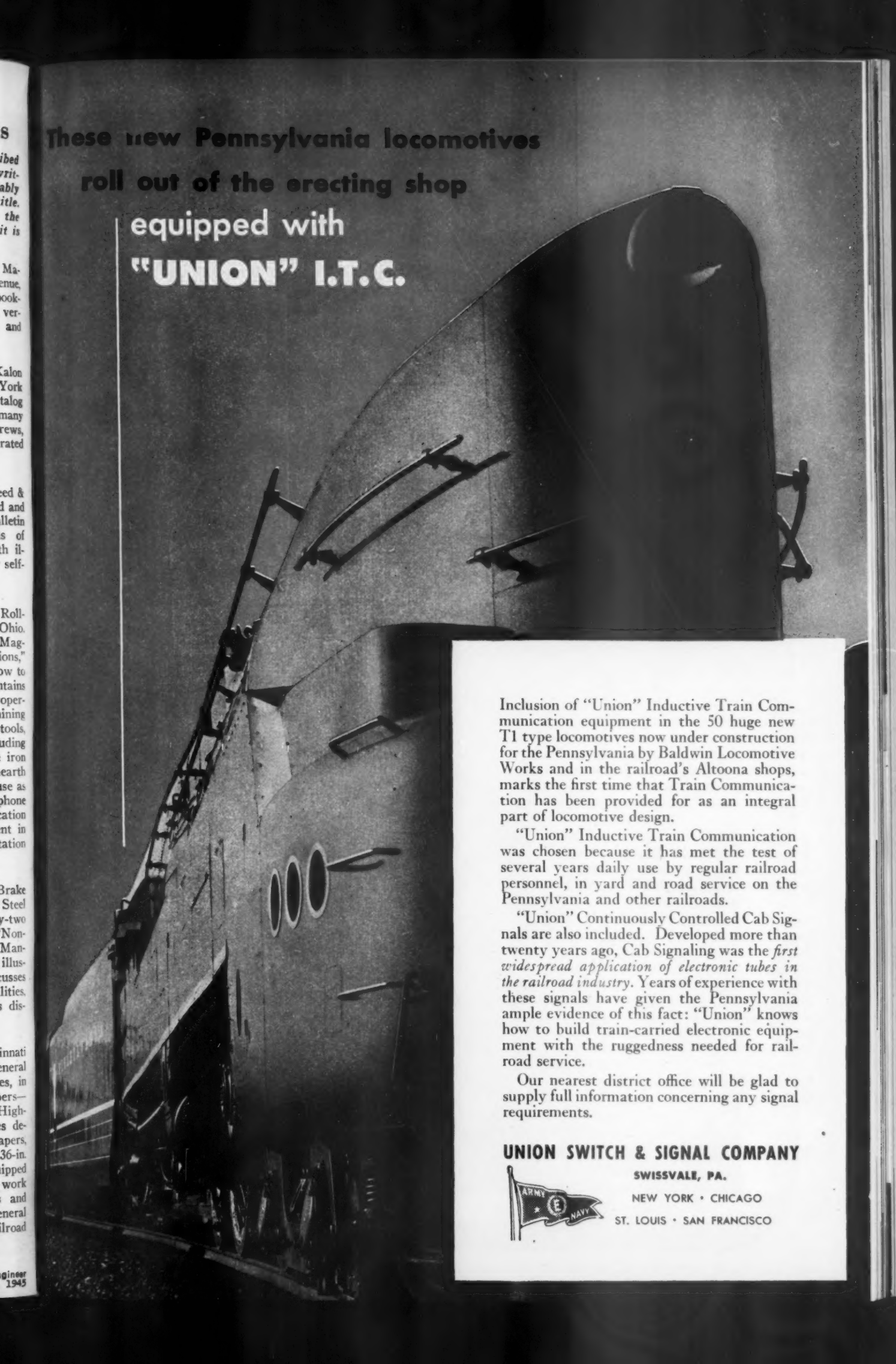
MAGNETIC INGOT IRON.—American Rolling Mill Company, Middletown, Ohio. Twenty-four page booklet, "Armco Magnetic Ingot Iron for D. C. Applications," illustrated with charts. Section on How to Fabricate Magnetic Ingot Iron contains data on effect of strains on magnetic properties; hot and cold working; machining operations with the aid of standard tools, and accepted methods of welding, including tables on best electrodes to use. The iron is described as a highly refined open-hearth iron with high conducting power for use as magnetic cores for cyclotrons to telephone and telegraph wires for communication systems and as a conductor of current in various kinds of electrical transportation equipment.

◆

MANGANESE STEEL.—American Brake Shoe Company, American Manganese Steel Division, Chicago Heights, Ill. Thirty-two page Bulletin, No. 1144-NM, entitled "Non-Magnetic Applications for Amsco Manganese Steel," presents studies, with illustrations, of typical applications. Discusses Amsco production and research facilities, what manganese steel is, how it was discovered, etc.

◆

CINCINNATI SHAPERS.—The Cincinnati Shaper Co., Cincinnati 25, Ohio. General Catalog N-3. Describes and illustrates, in color, the five types of Cincinnati shapers—Rapid Traverse, Universal, Utility, High-Speed, and Railroad types. The sizes described in the section on Railroad shapers, which is entirely new, are 32-in. and 36-in. heavy-duty Rapid Traverse types equipped with special features for emergency work on driving boxes, crossheads, shoes and wedges, main rod brasses, and other general repair and maintenance work in railroad shops.



Inclusion of "Union" Inductive Train Communication equipment in the 50 huge new T1 type locomotives now under construction for the Pennsylvania by Baldwin Locomotive Works and in the railroad's Altoona shops, marks the first time that Train Communication has been provided for as an integral part of locomotive design.

"Union" Inductive Train Communication was chosen because it has met the test of several years daily use by regular railroad personnel, in yard and road service on the Pennsylvania and other railroads.

"Union" Continuously Controlled Cab Signals are also included. Developed more than twenty years ago, Cab Signaling was the *first widespread application of electronic tubes in the railroad industry*. Years of experience with these signals have given the Pennsylvania ample evidence of this fact: "Union" knows how to build train-carried electronic equipment with the ruggedness needed for railroad service.

Our nearest district office will be glad to supply full information concerning any signal requirements.

UNION SWITCH & SIGNAL COMPANY

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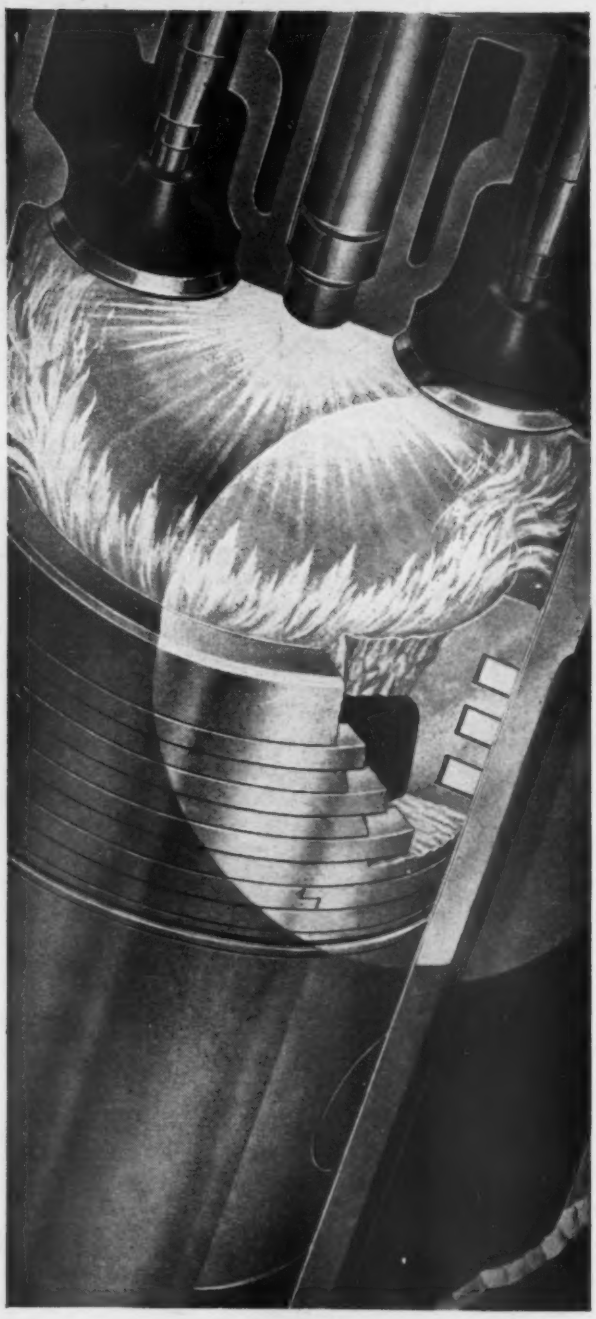
GET PROTECTION IN THE RIGHT SPOT!



CORRECT LUBRICATION—

by Socony-Vacuum assures Oils and Greases exactly right for every Diesel and Track Tool Need!

● Inside Diesel Locomotive cylinders like this, terrific pressure and scorching 3500° heat team up against the lubricating oil.

Gargoyle D.T.E. Oils (Nos. 1 to 5) are made especially to withstand these severe operating conditions. They reduce deposits to an absolute minimum. Any deposits that do form are soft and flaky—do not cause piston rings to stick.

Just as important, these oils provide strong films that resist rupture, reduce wear on pistons, cylinders, rings.

Gargoyle D.T.E. Oils are also giving excellent performance in large stationary units and marine Diesels.

In your smaller, automotive-type Diesels, Delvac 900 Series Oil gives vital moving parts similar protection.

You'll find the correct grades of these proved oils assure continuous, top power output and full protection of Main Line and Maintenance-of-Way Diesels.

SOCONY-VACUUM OIL COMPANY, INC.
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KEEP ROADWAY EQUIPMENT ON THE JOB WITH QUALITY LUBRICANTS

To help you get more continuous, trouble-free operation from maintenance-of-way equipment, Socony-Vacuum has worked closely with builders...has developed special oils and greases which meet the exact needs of all tools and their motors.

For example, special Socony-Vacuum oils resist the washing action of water in air tools, like those shown above...protect their moving parts against wear and rusting. Other quality lubricants keep mobile air compressors at peak efficiency.

TRACTORS. Special Socony-Vacuum oils give maximum protection against wear...help keep pistons, rings, valves and bearings *clean*...engines operating at full power. Special greases seal out grit, dirt and water from all chassis fittings.

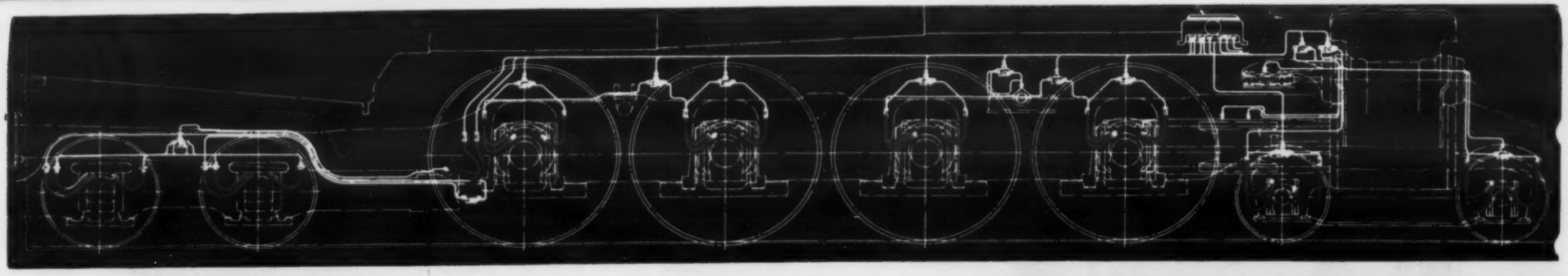
RAILROAD CRANES and other heavy equipment. Get the best possible protection for engines, transmissions, heavy exposed gears and other vital parts with special railroad lubricants. Consult your Socony-Vacuum Representative next time he calls.

GARGOYLE Railroad Lubricants

IT PAYS TO KNOW WHAT'S NEW IN LUBRICATION

SOCONY-VACUUM OIL COMPANY, INC.

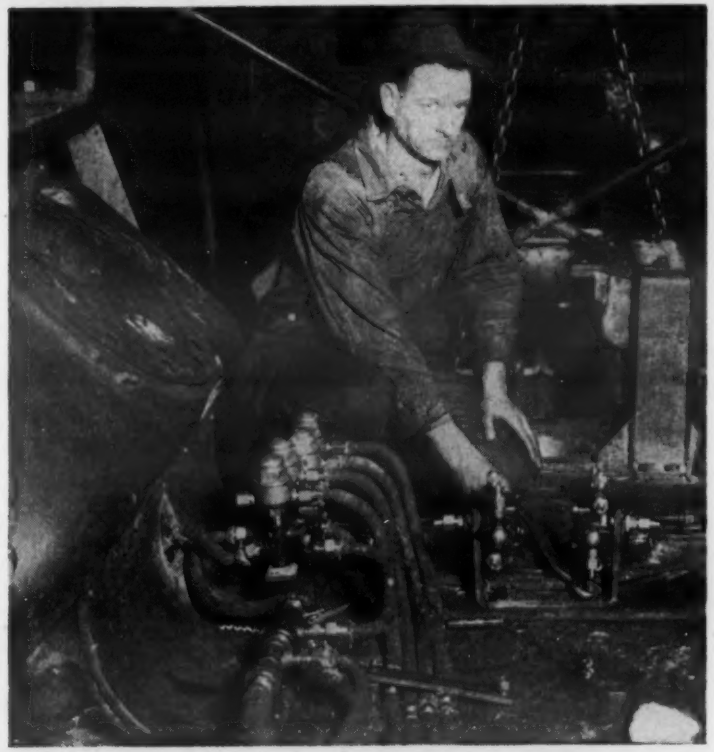
TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.S.T.—NBC



SPECIFY **Flex-O-Tube**

HIGH PRESSURE HYDRAULIC HOSE ASSEMBLIES

For Efficient Chassis Lubrication



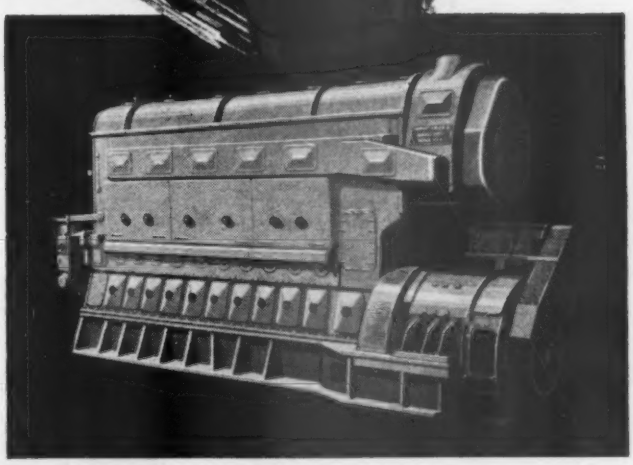
Efficient, economical operation of chassis locomotive lubricators depends in no small degree on the design and workmanship of the flexible hose assembly. Flex-O-Tube High Pressure Hose Assemblies provide flexible, trouble-free connections for all lubrication lines to journals, hubs, shoes and wedges, as shown in the above typical application.

In addition, Flex-O-Tube Assemblies are also used by many roads to assure efficient lubrication to guides, crossheads and other vital locomotive parts.

FLEX-O-TUBE COMPANY

Detroit — Lafayette and Fourteenth Streets — Michigan

TOMORROW'S POWER TODAY!

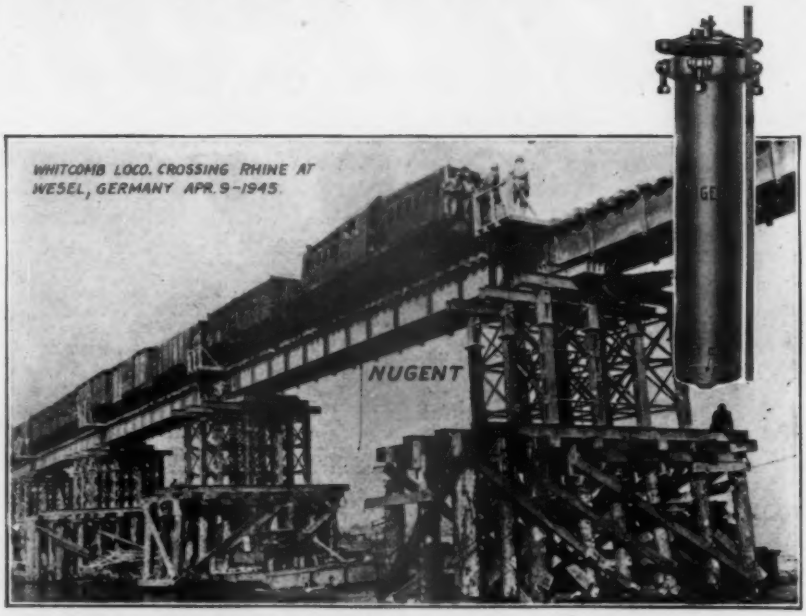


It's the Full-Power Diesel Locomotive by

FAIRBANKS-MORSE

A name worth remembering

...when the end began for Germany...



U. S. Signal Corps Photo

FIRST U. S. LOCOMOTIVE CROSSES RHINE—APRIL 9, 1945

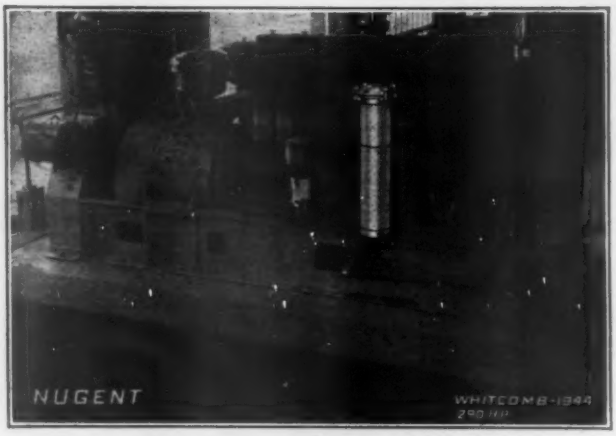


Photo shows Nugent filter on one of the two 290 H.P. Diesel engines in Whitcomb locomotive that crossed Rhine.

DISTRIBUTORS

Industrial Equipment Co., 6435 Hamilton Ave., Detroit, Michigan.

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580 H.P. WHITCOMB LOCOMOTIVE EQUIPPED WITH NUGENT FILTER

ON APRIL 8, 1945, Army engineers, cooperating with the Transportation Corps' Second Military Railway Service, completed the first railroad link across the Rhine at Wesel, Germany. The connection consisted of a 1,752-foot, single track bridge over the river itself, and a 463-foot bridge spanning a nearby canal.

On April 9, 1945, the first train rolled over the bridge . . . loaded with tons of the rations and supplies needed to help our troops crush resistance in Germany's inner fortress. This train was hauled by a 580 H.P. Whitcomb Locomotive which was equipped with a Nugent Absorbent Type Lubricating Oil Filter.

You can depend on Nugent Oil Filters to give complete protection against dirt in fuel or lubricating oil. Nugent Filters have 20% more filtering area than most filters of comparable size, require less maintenance, keep oil cleaner and keep engines running better—longer. Write for Bulletin 7A.

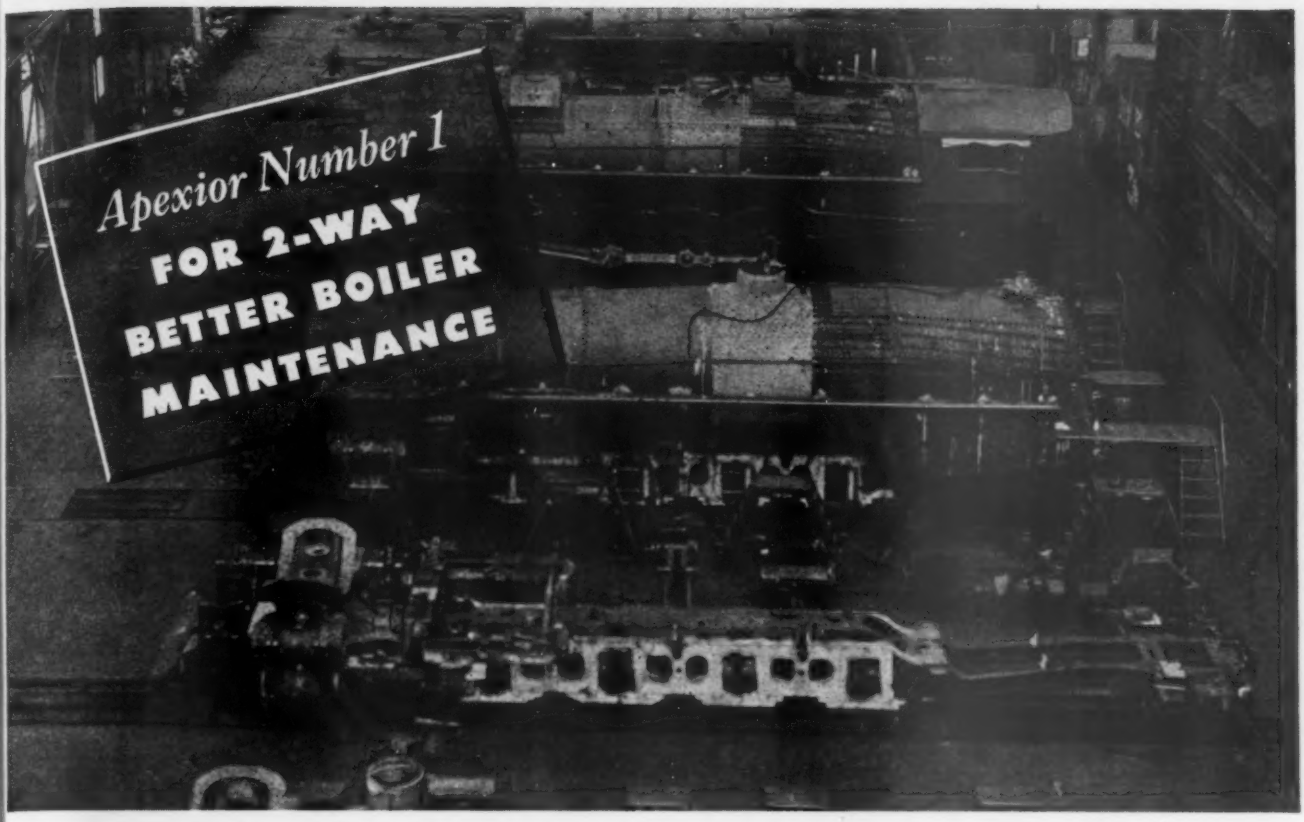
Nugent Filters

ESTABLISHED 1897

WM. W. NUGENT & CO., INC.

431 N. HERMITAGE AVE. CHICAGO 22, ILLINOIS

Fuel Oil Filters
Lube Oil Filters
Lubricating Systems
Sight Flow Indicators
Oiling Devices



Cleaner Operation . . . Shorter Shopping Time

You gain two ways when your locomotive boiler shells are surfaced with APEXIOR NUMBER 1.

Dirt and scale find no crevices to cling to when metal surfaces are APEXIORIZED. The smooth surface and lack of contact with the metal itself prevent chemical bonding, strong adhesion.

The tough, durable film of APEXIOR NUMBER 1, a few thousandths of an inch thick, does not retard heat transfer. On the contrary, by retarding the deposit of heat-insulating layers of scale and dirt, it prolongs the period of high heat-transfer efficiency.

The absence of chemical bonding, permitting only loose adhesion of solids to APEXIOR NUMBER 1, results in easier cleaning.

SIMPLIFIES FEEDWATER SERVICE

APEXIOR NUMBER 1 assists the work of the water service department by increasing the durability and raising the surface quality of boiler metal. It is not a substitute for feedwater preparation and is inert to the chemicals used. It protects the metal under boiler water and steam temperatures and pressures. APEXIOR NUMBER 1 is regularly used on thousands of locomotives subject to I.C.C. Inspection.

APEXIOR NUMBER 3 FOR "COLD-WET" SURFACES

The water-side of locomotive tender cisterns is protected against cold water contact by this brush-applied shiny, jet-black technical protective coating. For water protection under 125°F. APEXIOR NUMBER 3 is inert and non-toxic.

APEXIOR ALWAYS AVAILABLE

Expanded production makes APEXIOR surfacing materials available for shipment every day to railroads, industrial power plants, utilities and marine users throughout the country. See information in *Locomotive Cyclopaedia.*

Write for bulletin today.

APEXIOR — *Keeps new metal new . . . Gives old metal new life* — DAMPNEY

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Hyde Park, Boston 36, Mass.

Please send free Bulletin.

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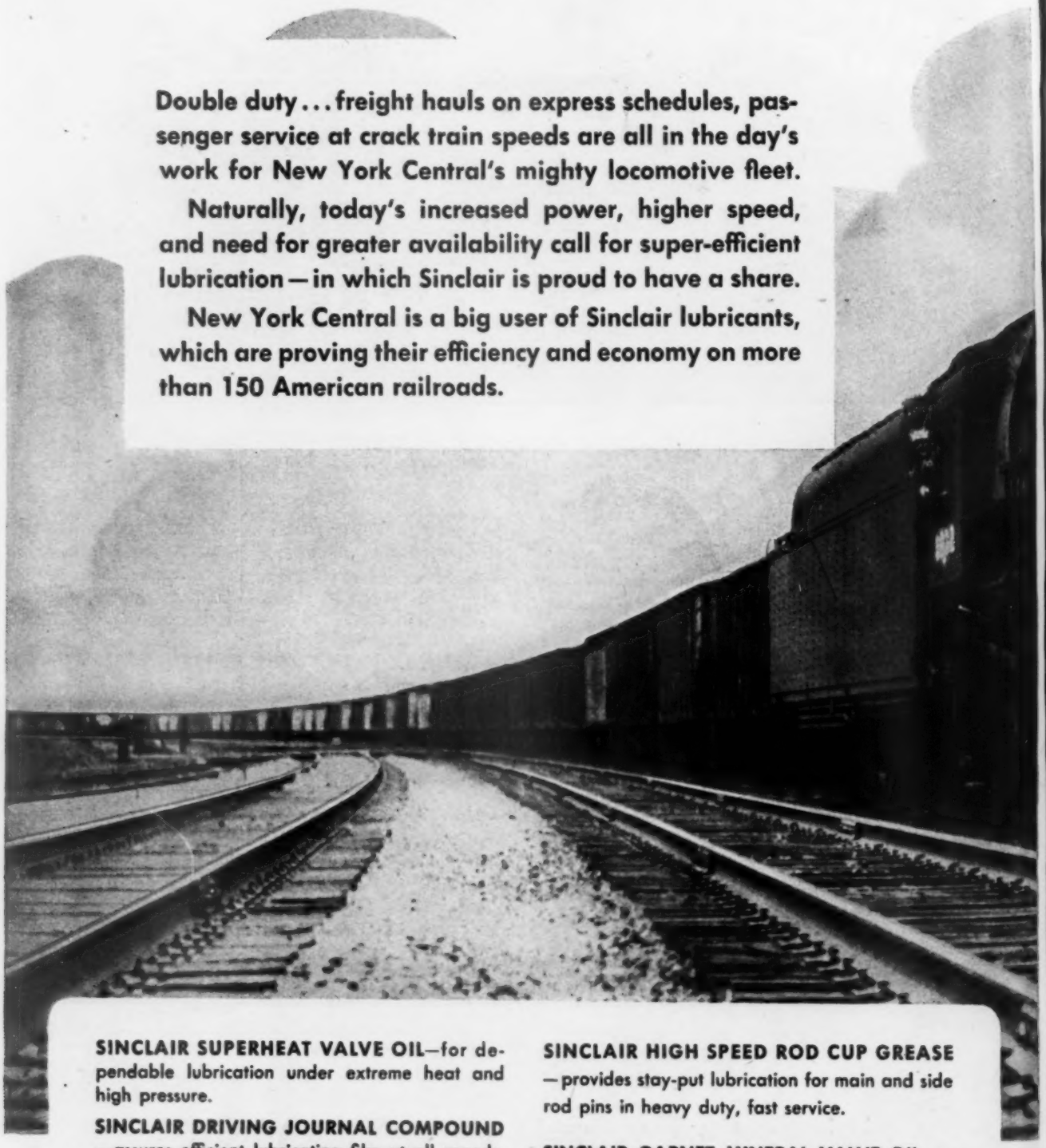
Doing DOUBLE DUTY *with*

Double duty... freight hauls on express schedules, passenger service at crack train speeds are all in the day's work for New York Central's mighty locomotive fleet.

Naturally, today's increased power, higher speed, and need for greater availability call for super-efficient lubrication—in which Sinclair is proud to have a share.

New York Central is a big user of Sinclair lubricants, which are proving their efficiency and economy on more than 150 American railroads.



SINCLAIR SUPERHEAT VALVE OIL—for dependable lubrication under extreme heat and high pressure.

SINCLAIR DRIVING JOURNAL COMPOUND—assures efficient lubricating film at all speeds.

SINCLAIR CAR and ENGINE OILS—low-pour lubricants to guard against hot box troubles.

SINCLAIR HIGH SPEED ROD CUP GREASE—provides stay-put lubrication for main and side rod pins in heavy duty, fast service.

SINCLAIR GARNET MINERAL VALVE OIL—a heavy duty lubricant for rod and driving journal roller bearings.

NEW YORK CENTRAL

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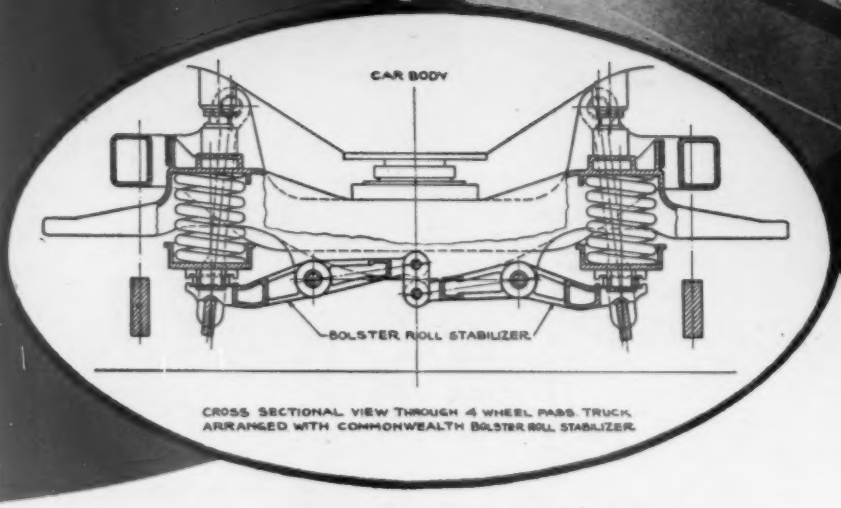
RAILROAD LUBRICANTS

SINCLAIR REFINING COMPANY, *RAILWAY SALES*, NEW YORK · CHICAGO · ST. LOUIS · HOUSTON

FOR SMOOTHER, QUIETER



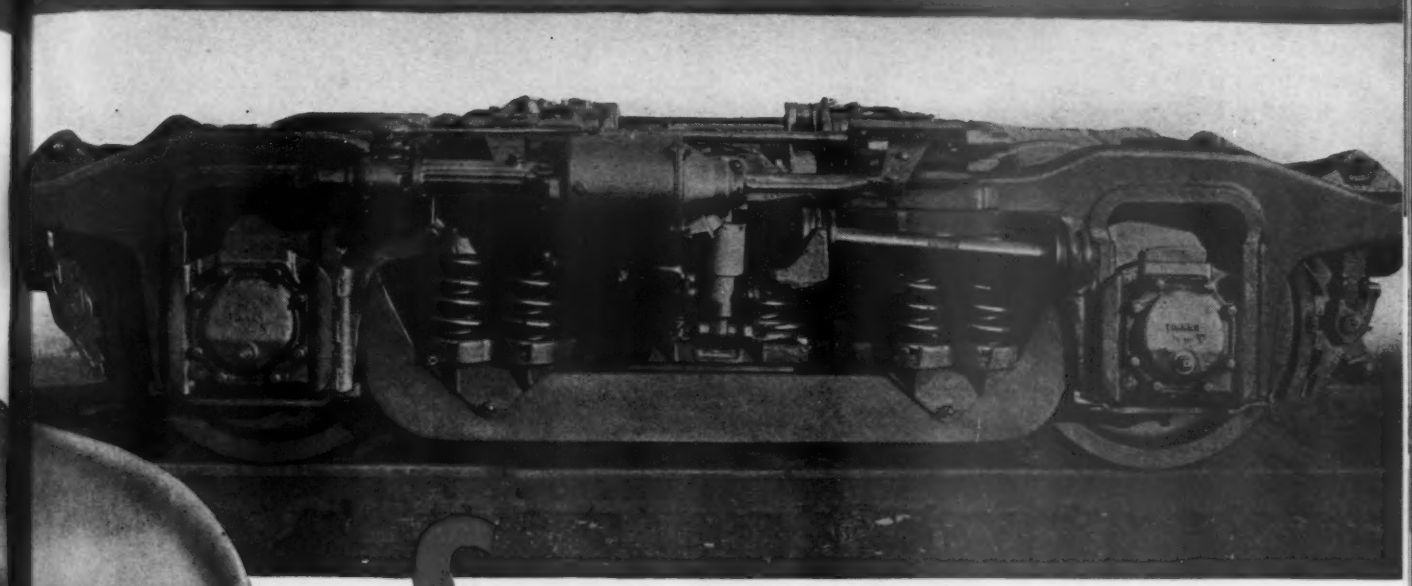
CROSS SECTIONAL VIEW THROUGH 4 WHEEL PASS. TRUCK ARRANGED WITH COMMONWEALTH BOLSTER ROLL STABILIZER

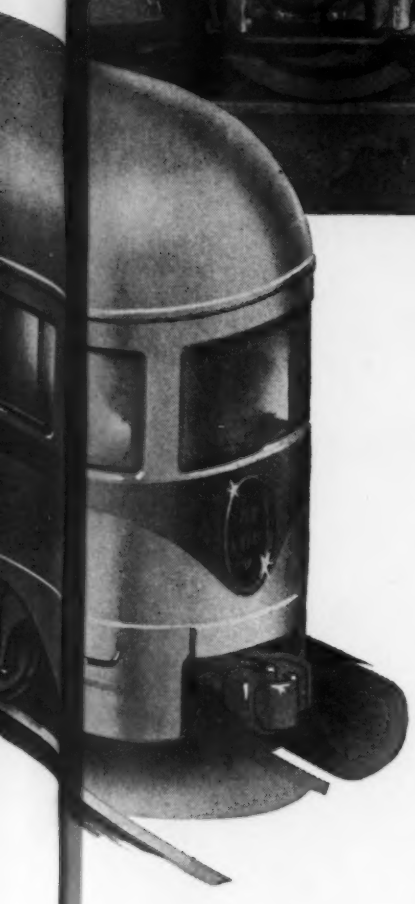
COMMONWEALTH BOLSTER ROLL STABILIZER

THIS stabilizer was developed especially for sleeping cars, diners, lounge, and observation cars, to prevent car body roll. It is composed of a split spring plank, the two separate parts of which are connected to each other and to the bolster so as to prevent the bolster from moving out of plane with the track and over-loading the springs. This feature results in positive mechanical control of car roll and allows the use of more flexible coil springs, further improving riding qualities.

GENERAL STEEL

ER SAFER RIDING AT HIGH SPEEDS





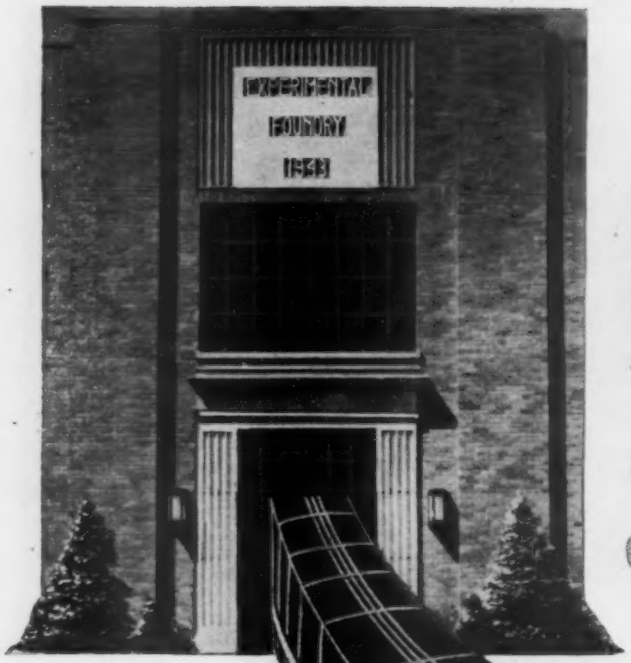
Specify This COMMONWEALTH Passenger Car Truck

DESIGNED for light-weight, high-speed transportation, this COMMONWEALTH 4-Wheel Passenger Car Truck is equipped with bolster and equalizer coil springs, shock absorbers, bolster anchors, and, if desired, bolster roll stabilizers. These advanced design features assure the best possible riding qualities at high speeds, freedom from vibration and lateral sway, insuring greater passenger comfort and safety.

This modern truck utilizes Commonwealth one-piece alloy cast steel truck frame, bolster, and spring plank or bolster roll stabilizer castings—providing greater strength with minimum weight, utmost serviceability at lowest maintenance expense.

The fact that America's finest trains are equipped with Commonwealth trucks is proof of their superior performance under every type of service condition.

L CASTINGS EDDYSTONE, PA. GRANITE CITY, ILL.



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Here's help in finding tougher, longer-wearing bearings and bronze parts for any problems and applications.

We are eager to work with you hand-in-hand and perfect better alloys and designs to keep pace with the progress of the railroad industry which we have served for 71 years.

Our metallurgical laboratories, experimental foundry, and our staff of research engineers are at your disposal.

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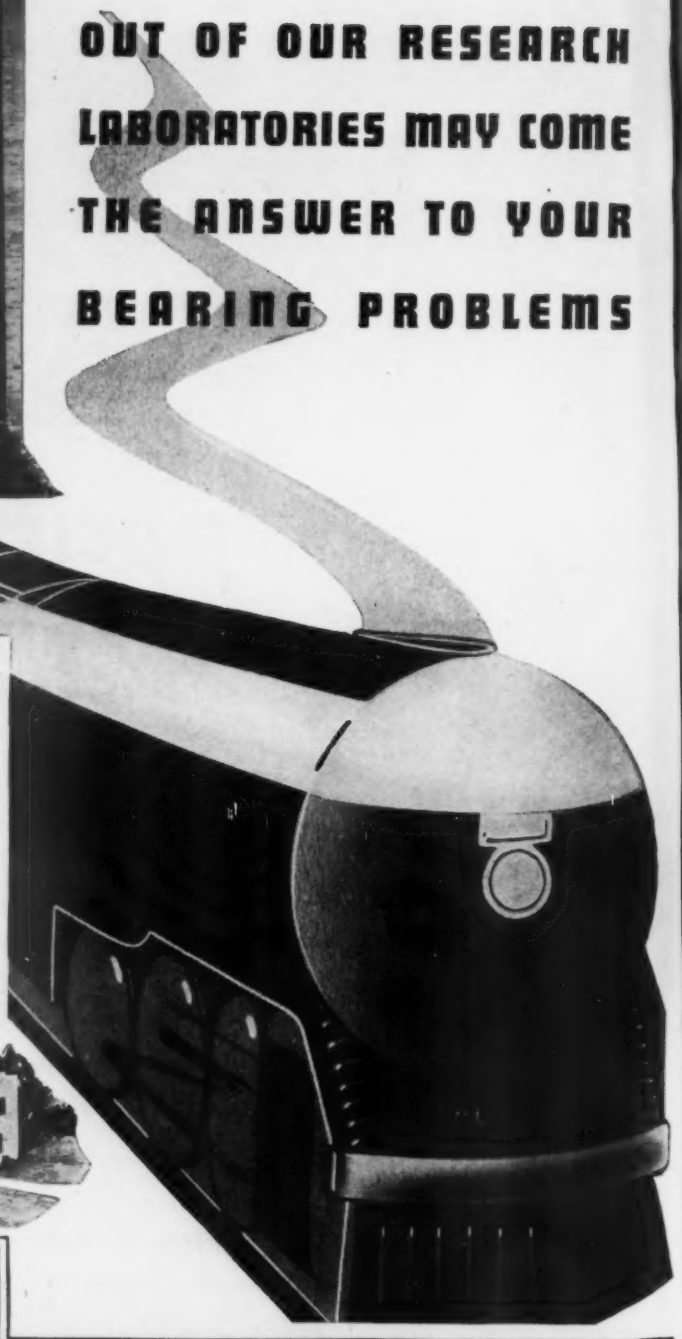
3. *Experimental Foundry*



NBM

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AMERICAN Brake Shoe COMPANY

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NOW · YOU CAN GET
American
Hammered
IN EVERY SIZE · OF EVERY TYPE · FOR EVERY PURPOSE

You can get all the American Hammered Piston Rings you need, in any size . . . of any type . . . for any purpose . . . just as promptly as you did in pre-war years.

You'll find that these new rings reflect a quarter-century of peacetime skill and experience and *another* quarter-century of experience and progress that was crowded, by the needs of the nation, into five years on the calendar.

Wartime accomplishments include the production or perfection of such revolutionary new developments as the wear-banishing "PORUS-KROME" * treatment, and the life-extending, performance-boosting high-tensile alloys.

Let us demonstrate that now as in the past, American Hammered Piston Rings plus American Hammered engineering service give the answer to every ring need.

KOPPERS COMPANY, INC.

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* Van der Horst Process

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

STANDARD STOKER *Fired*

NEW YORK CENTRAL'S NIAGARA CLASS 6000 H. P. DUAL PASSENGER AND FREIGHT LOCOMOTIVE

Equipped with STANDARD HT STOKER

THE NIAGARA, first of a number of dual-purpose locomotives to be built for the New York Central, is designed to handle effectively fast passenger trains and also to meet the demands for high speed freight service. This modern locomotive embodies notable advances in reciprocating steam locomotive design providing increased power, economy, efficiency and utilization.

Standard HT Stokers will handle the all-important firing job on the entire fleet of Niagara locomotives thus assuring dependable operation and maximum firing efficiency so essential in producing sustained tractive effort.

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NEW YORK • CHICAGO • ERIE • MONTREAL

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RELIANCE

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Exhibit in print...

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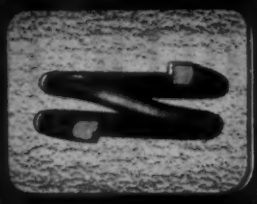


THACKERAY HY-CROME

Pin-Up Pictures of Reliance Hy-Crome Spring Washers do not display shapeliness in the usual pin-up manner but their form and size is all important in the job they do.

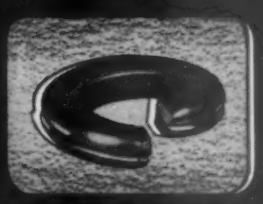
The various types of Reliance Hy-Crome Spring Washers are designed to specifications established through careful experimentation efforts in the field and laboratory to determine the best shape of section for each specific application and to meet the service condition.

Select from our Pin-Up Pictures of Reliance Hy-Crome Spring Washers the one best suited to your purpose to keep track and motive power bolts tight through Hy-Crome's unfailing compensating factor, which combats the effect of looseness resulting from inevitable wear. Contact Reliance Service Engineers for information on your fastening problem and samples for test.

LOCOMOTIVE HY-CROME

HY-REACTION HY-CROME

STANDARD HY-CROME



HY-PRESSURE HY-CROME

HY-CROME PRESSURE SPRING

EATON

EATON MANUFACTURING COMPANY

Greetings to the members of the Co-ordinated Mechanical Associations and the many railroad friends we usually have the pleasure of seeing at this convention. We trust the opportunity to revive these mutually profitable get-togethers will be resumed next year.

Reliance Division

MASSILLON, OHIO

SALES OFFICES:

NEW YORK • CLEVELAND • DETROIT • CHICAGO • ST. LOUIS • SAN FRANCISCO • MONTREAL

REPUBLIC ELECTRUNITE BOILER TUBE

It's Republic's improved process of electric resistance welding . . . a process in which tremendous electrical energy combines with pressure to fuse together the clean edges of a cold-formed tubular shape without the addition of any metal. The ELECTRUNITE Process of welding and normalizing produces a sound tube with a weld area identical with the rest of the tube wall.

In thousands of tests, many conducted by independent, impartial research laboratories, Republic ELECTRUNITE Boiler Tubes *repeatedly* have demonstrated their ability to withstand pressures far greater than those which might be encountered in the most severe service.

But there are other reasons, too, why more than 150,000,000 feet of ELECTRUNITE Pressure Tubes have been installed in all types of steam generating and heat transfer equipment.

These *modern* boiler tubes are *clean.* Because they are free of scale, there is less danger of localized corrosion causing premature tube failure and costly retubing down-time.

Many cost-wise users prefer Republic ELECTRUNITE Boiler Tubes, because they are consistently uniform in diameter, wall thickness and roundness —qualities which speed up retubing and get vitally needed equipment back on the job in a hurry.

NOW is the time to investigate fully these and the many other advantages of *dependable* ELECTRUNITE Boiler Tubes. Write directly to:

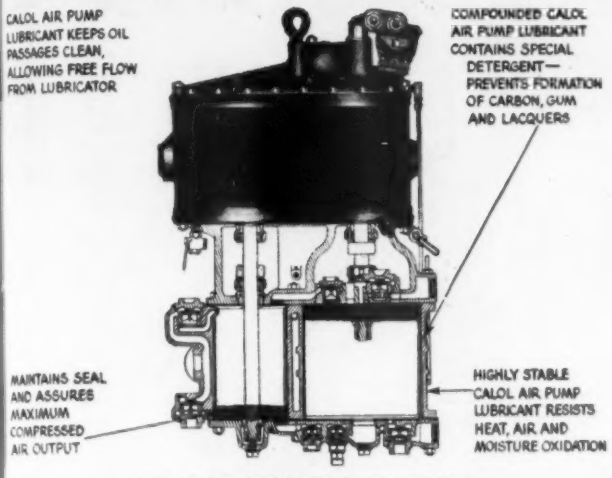
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

INSPECTED INSIDE AND OUT

Republic ELECTRUNITE Boiler, Condenser and Heat Exchanger Tubes are made from highest quality flat-rolled steel, both sides of which are open to close visual inspection. Thus, the surface which becomes the inside wall when formed into tubing is free from hidden defects.

Republic
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

STANDARD ENGINEERS NOTEBOOK


CALOL AIR PUMP LUBRICANT KEEPS OIL PASSAGES CLEAN, ALLOWING FREE FLOW FROM LUBRICATOR
COMPOUNDED CALOL AIR PUMP LUBRICANT CONTAINS SPECIAL DETERGENT— PREVENTS FORMATION OF CARBON, GUM AND LACQUERS
MAINTAINS SEAL AND ASSURES MAXIMUM COMPRESSED AIR OUTPUT
HIGHLY STABLE CALOL AIR PUMP LUBRICANT RESISTS HEAT, AIR AND MOISTURE OXIDATION

CROSS COMPOUND STEAM DRIVEN AIR COMPRESSOR

Oil cuts locomotive air-pump trouble

The time spent on maintenance of air pumps has been reduced for many roads by lubricating the air ends with Calol Air Pump Lubricant. In a service where a 30-day clean-up period was normal with cylinder and valve oils in air pumps, these units were clean and in excellent condition after operating on Calol Air Pump Lubricant for a much longer time.

In making Calol Air Pump Lubricant, special additives are compounded with selected low-carbon-forming oils. These additives prevent the formation of carbon, gum and lacquer and remove deposits. They also give the oil an extremely high stability to oxidation in the presence of heated air.

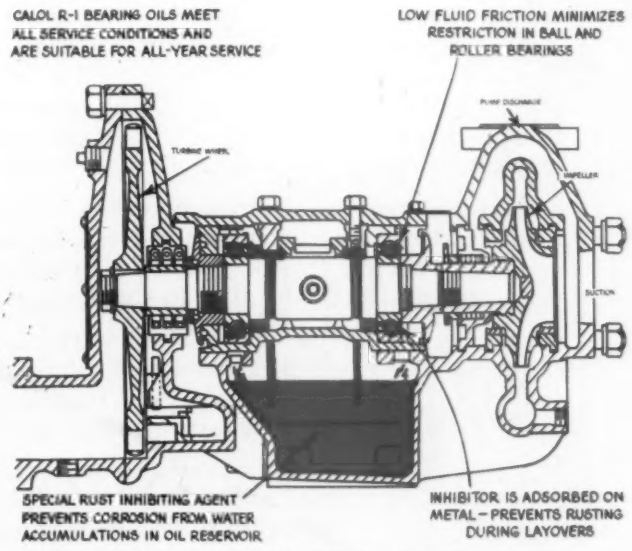
Maintaining a tight seal, Calol Air Pump Lubricant helps secure maximum efficiency from both Westinghouse and New York locomotive air pumps.

Anti-friction bearing rust stopped by inhibitor

The problem of rust formation in feed-water pump, generator and other ball and roller bearings on locomotives may be solved by lubricating these units with Calol R-I Bearing Oils.

Calol R-I Bearing Oils contain a special rust inhibitor that is adsorbed on bearing surfaces. This forms an impervious coating on oil wetted surfaces that bars water from contact with the metal. It provides protection from general corrosion that might occur when water accumulates in bearing reservoirs during wet weather or washings, and spotty corrosion that may be caused by drops left on surfaces during layovers.

Three viscosity grades of Calol R-I Bearing Oils meet all anti-friction bearing requirements: No. 150 for driving journals; No. 70 for trucks and trailers; No. 15 for feed-water pumps and generators.

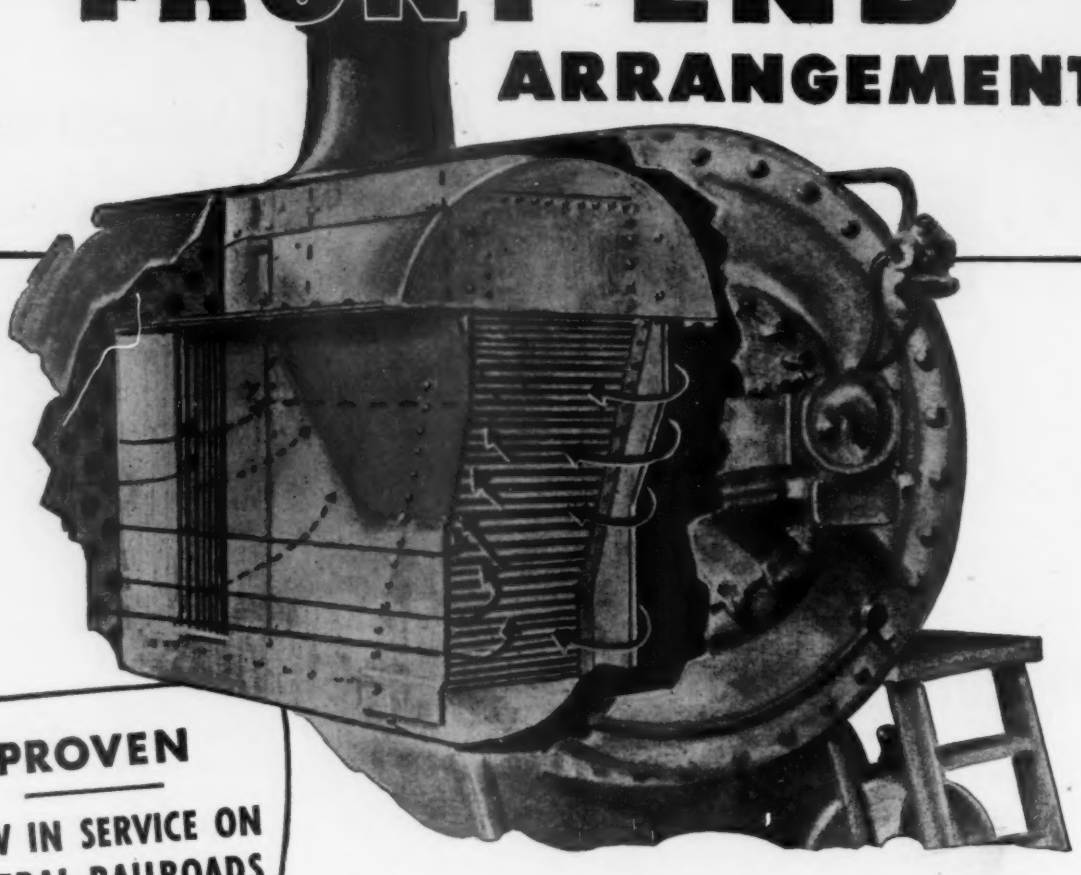

CALOL R-I BEARING OILS MEET ALL SERVICE CONDITIONS AND ARE SUITABLE FOR ALL-YEAR SERVICE
LOW FLUID FRICTION MINIMIZES RESTRICTION IN BALL AND ROLLER BEARINGS
SPECIAL RUST INHIBITING AGENT PREVENTS CORROSION FROM WATER ACCUMULATIONS IN OIL RESERVOIR
INHIBITOR IS ADSORBED ON METAL—PREVENTS RUSTING DURING LAYOVERS

CENTRIFUGAL BOILER FEED PUMP UNIT

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

AMWELD
FRONT END
ARRANGEMENT



PROVEN

NOW IN SERVICE ON SEVERAL RAILROADS

The three major factors to be considered in a locomotive front end arrangement are efficiency of operation, maintenance and the elimination of sparks.

The AMWELD FRONT END increases operating efficiency by maintaining a more equalized draft through all the flues and providing a streamlined flow of the gases which permits the use of a larger exhaust nozzle resulting in lower back pressure.

Maintenance is held to a minimum with the AMWELD FRONT END by the equalized draft resulting in a reduction in flue cutting and the incorporation of rolled steel louvers which do not become plugged or burned. The sturdy structure is designed to operate from shopping to shopping without attention.

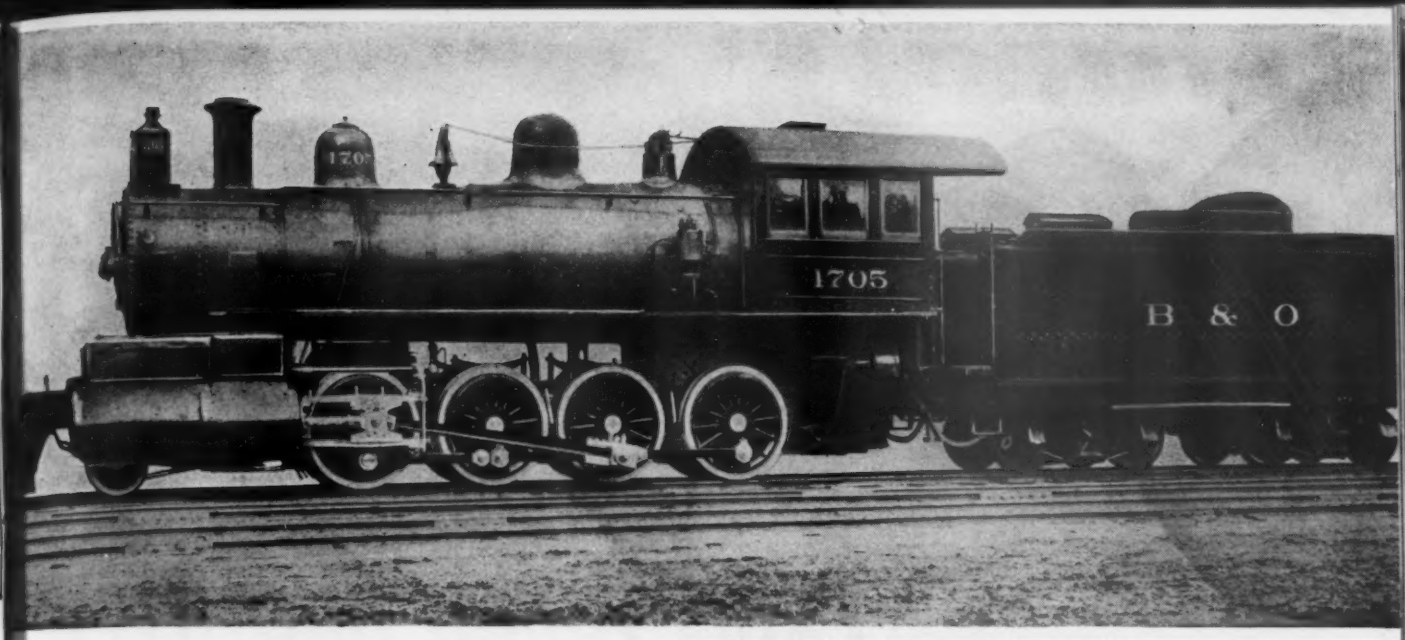
The rolled steel louvers in the AMWELD FRONT END provide an efficient means of eliminating sparks by their arrangement in a series of inverted "V's". This design does not permit the large cinders to pass and crushes the small cinders against the back side of the "V's".

One of our engineers will gladly discuss in detail the merits and economies of the AMWELD FRONT END. Several railroads have adopted it for benefits and economies best suited to their particular operations.

RAILWAY EQUIPMENT DIVISION

THE AMERICAN WELDING & MANUFACTURING CO.

WARREN, OHIO

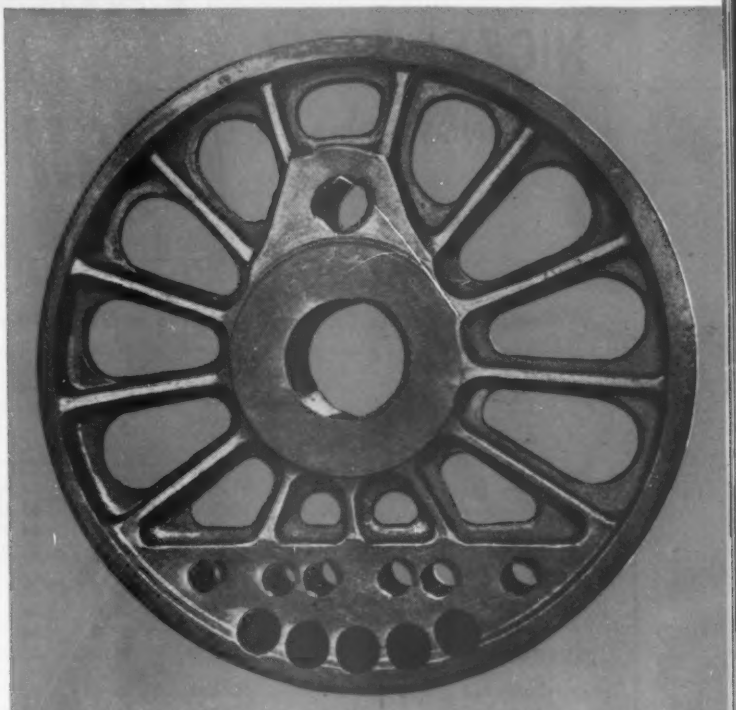


Another Step in the Search for

HIGHER PERFORMANCE

In the early years of the 20th century, nearly all railroads and locomotive builders were experimenting with compound engines. One of the many types was this "tandem compound" shown above, which was built for the B. & O. by Pittsburgh Locomotive Works... No. 1705 did not come up to expectations and was later rebuilt into a single expansion engine.

In today's search for higher performance, the higher loads, thrusts and speeds demand Driving Wheel Centers designed for the locomotives of tomorrow.



UNION WEB SPOKE DRIVING WHEEL CENTER

- ★ Cruciform section spokes for great additional strength.
- ★ Reinforced rim support to eliminate flat spots, out of roundness, etc.
- ★ Correct distribution of metal for better balancing of small diameter wheels.
- ★ Wheels easily inspected before and after installation.
- ★ Troubles due to shrinkage eliminated by simplicity of design.
- ★ Can be made to any material specification.

UNION STEEL CASTINGS DIVISION OF BLAW-KNOX CO.

2¼% Nickel Steel locomotive rods, one bent cold to show ductility.

QUENCHED AND TEMPERED

NICKEL STEEL FORGINGS COMBINE EXCEPTIONAL DUCTILITY WITH HIGH TENSILE STRENGTH

Composition and Typical Properties of Normalized Quenched and Tempered 2¼% Nickel Steel Rods

Description	Yield Pt. No. Lbs. per Sq. In.	Tensile Strength Lbs. per Sq. In.	Elong. % in 2 In.	Reduction in Area %	ANALYSIS					
					Car.	Mang.	Phos.	Sul.	Sil.	Ni
Main Rod....	92900	110000	25.0	64.4	.31	.78	.027	.026	.25	2.75
Main Rod....	86500	104500	25.5	65.6	.32	.86	.034	.032	.29	2.69
Main Rod....	86360	104400	26.0	64.8	.32	.86	.034	.032	.29	2.69
Main Rod....	87850	102350	26.0	66.2	.31	.89	.037	.025	.32	2.69
Front Rod....	86000	102250	25.0	67.3	.29	.82	.035	.027	.24	2.71
Front Rod....	83900	104250	25.0	66.1	.29	.82	.035	.027	.24	2.71
Front Rod....	86850	104250	27.0	66.1	.32	.86	.035	.025	.30	2.65
Front Rod....	89500	107050	25.5	65.6	.32	.86	.035	.025	.30	2.65
Back Rod....	89500	107650	25.0	62.7	.30	.79	.030	.025	.22	2.71
Back Rod....	87500	106450	25.0	65.4	.29	.82	.035	.027	.24	2.71
Back Rod....	87000	105600	25.0	65.4	.29	.82	.035	.027	.24	2.71
Back Rod....	88150	104850	26.0	66.8	.29	.82	.035	.027	.24	2.71

Specimens Taken from Mid-Section of Prolongations of the Forgings

The above table compiled by the American Locomotive Company shows the chemical compositions and mechanical properties of some normalized, quenched and tempered nickel steel front, main and back rods recently produced as replacement rods for locomotives being speeded up and rebalanced. These values are typical of replacement rod forgings recently tested by that company.

Quenched and tempered nickel steel forgings of this type provide high tensile strength and ductility, combined with unusual toughness and high fatigue strength—qualities which tend to obviate breakage when employed as rods in railroad service.

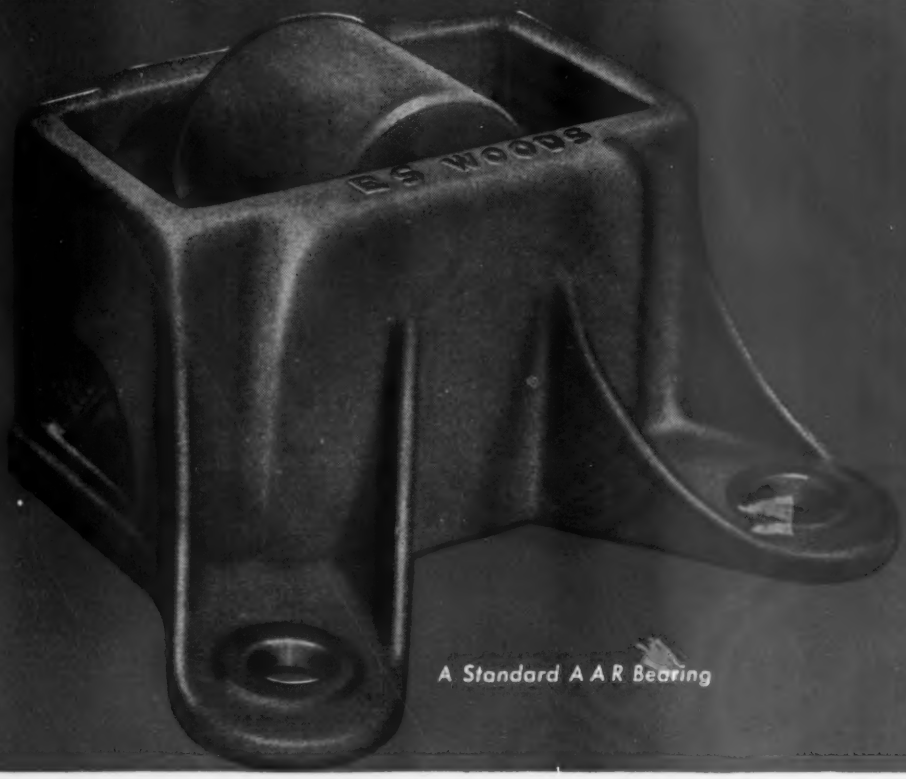
Now that the war is over and the War Production Board has revoked all restrictions concerning nickel, we wish to express to the Coordinated Mechanical Associations our thanks and appreciation for the fine cooperation extended in meeting the many unusual conditions which arose.

Our production facilities, as well as our current stocks, are ample to meet the needs of industry. Our sales and technical divisions are eager to be of service to you again in the use of our various products.

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

THE EDWIN S. WOODS & COMPANY

No. 1075 Roller Truck Side Bearing



A Standard A A R Bearing

assures *Free-swiveling* TRUCKS ON CURVES

Reduce Derailments—Friction at the side bearings must be eliminated or worn wheels may find it easier to climb the rails than to swivel the trucks on curves.

Increase Pay Load—Reduction of train resistance caused by pressure of wheels against curve rails adds to locomotive capacity.

Reduce Rail and Wheel Wear—Reduction of friction of wheels on curves adds life to both curve rails and wheel flanges.

Three point attachment of malleable iron

housing establishes rigidity and eliminates tipping. Trunnions on roller extend into, but are free from engagement with housing, and establishes a self-contained bearing. Side walls of the housing are designed of heavy sections of metal to take care of end thrust.

FORGED STEEL, HEAT-TREATED and oil-quenched roller, centers by gravity on a concave forged steel and heat-treated filler and has a travel of 7 inches.

EDWIN S. WOODS & COMPANY *Division of*

"Quality Since 1880"

PETTIBONE MULLIKEN CORPORATION

4710 West Division Street, Chicago 51, Illinois

Now Our Sec

FLANNERY'S WAR PRODUCTS

GUN BARRELS

Oerlikon	20 MM
Vickers	50 Cal
Buffalo Arms	M2
Buffalo Arms	A4
Colt	M2
Tommy Gun	45 Cal
Pistol	45 Cal
Enfield	30 Cal
Shot Gun	

SHAFTS

- Liberty Aircraft
- Ranger Aircraft
- Oldsmobile
- Berrylium

BOMB PARTS

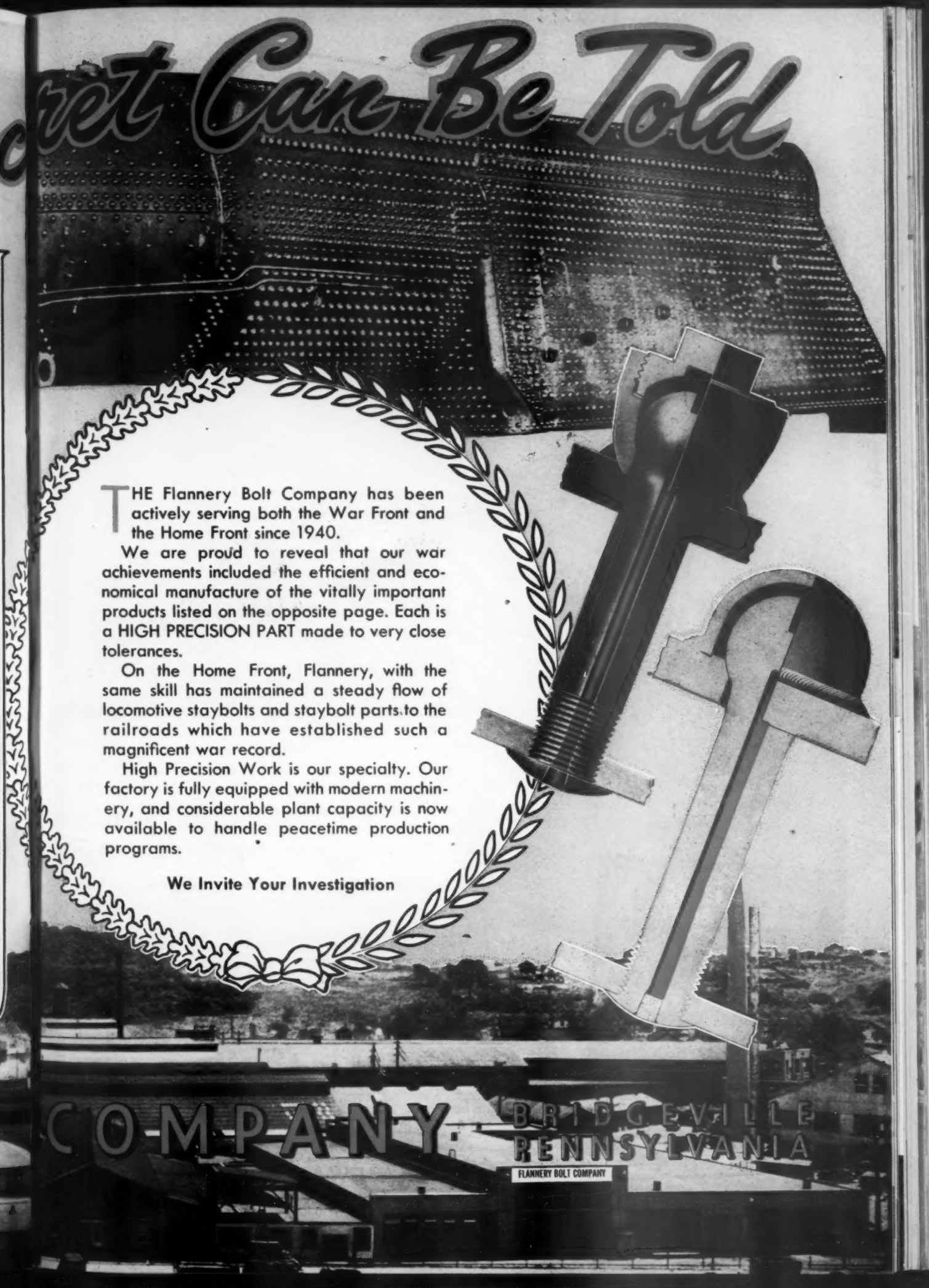
- Nose Closing Plugs
- Bodies
- Strikers

ROCKETS 115MM

- Shell Armor Piercing Heads
- High Explosive Heads
- Body Tubes
- Fin Assemblies
- Head Plugs
- Junctors
- Flame Throwers
- Armor Piercing Shot
- Grenade Launchers
- Flash Eliminators
- Oldsmobile Gas Tubes
- Barrel Jacket Assemblies
- Cover Assemblies
- Ajax Thermocouple Tubes
- Robertshaw Thermocouple Tubes
- Gun Bolts
- Trunnion Adapters

★

FLANNERY BOLT


ret Can Be Told
THE Flannery Bolt Company has been actively serving both the War Front and the Home Front since 1940.
We are proud to reveal that our war achievements included the efficient and economical manufacture of the vitally important products listed on the opposite page. Each is a HIGH PRECISION PART made to very close tolerances.
On the Home Front, Flannery, with the same skill has maintained a steady flow of locomotive staybolts and staybolt parts to the railroads which have established such a magnificent war record.
High Precision Work is our specialty. Our factory is fully equipped with modern machinery, and considerable plant capacity is now available to handle peacetime production programs.
We Invite Your Investigation
COMPANY
BRIDGEVILLE
PENNSYLVANIA
FLANNERY BOLT COMPANY

CRECO
THIRD POINT SUPPORT
holds brake rigging in alignment

THE sliding chair of the Creco Third Point Support rides on a flexible arm . . . presenting a cushioned movement that holds the brake rigging in the proper alignment.

The resiliency of this Third Point Support absorbs brake rigging vibration, and reduces brake head and brake shoe wear.

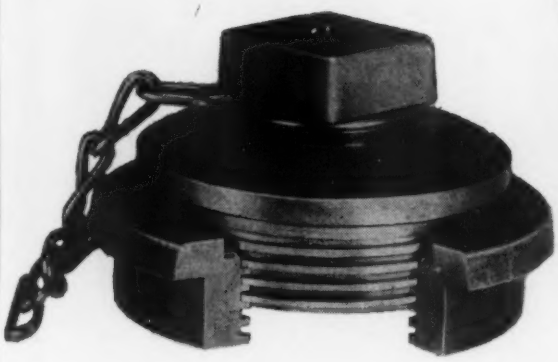
Moreover, the Third Point Support is a safety device, for it prevents a brake beam from falling to the track. The brake beam can be easily removed when desired.

CHICAGO RAILWAY EQUIPMENT CO.

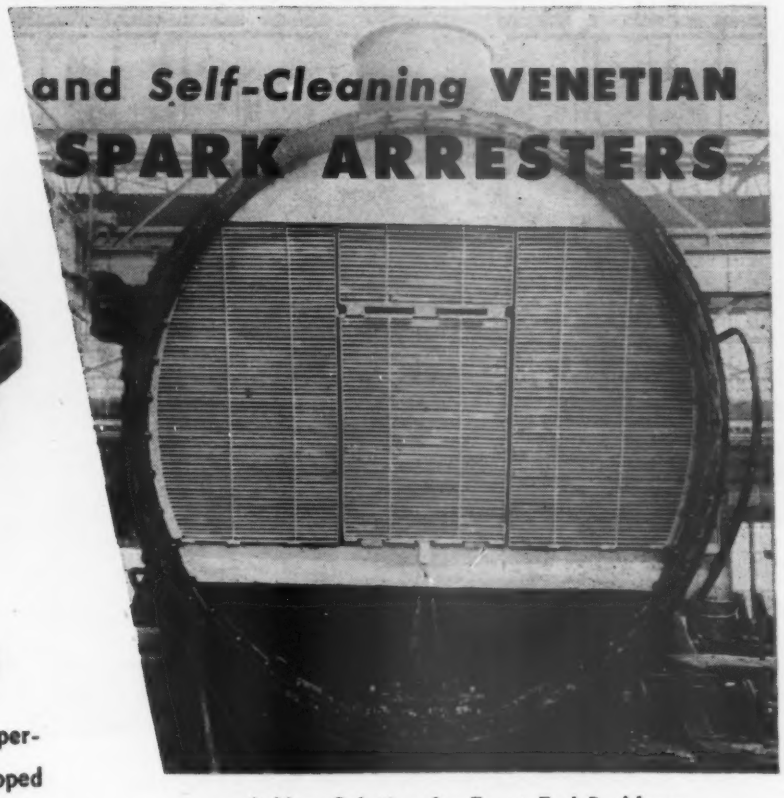
McCormick Building Chicago, Illinois

Huron

BOILER and TENDER PLUGS



and *Self-Cleaning* VENETIAN SPARK ARRESTERS



PROMOTE SAFETY AND CONSERVATION

NO ACCIDENTAL blowouts can occur to cause personal injury or damage when a boiler is equipped with Huron Washout Plugs. This safety feature is afforded by the Huron plug's strong square threads which cannot be crossed. Huron plugs also reduce maintenance expense incidental to boiler washout and inspection. Try them and see.

A New Solution for Front End Problems

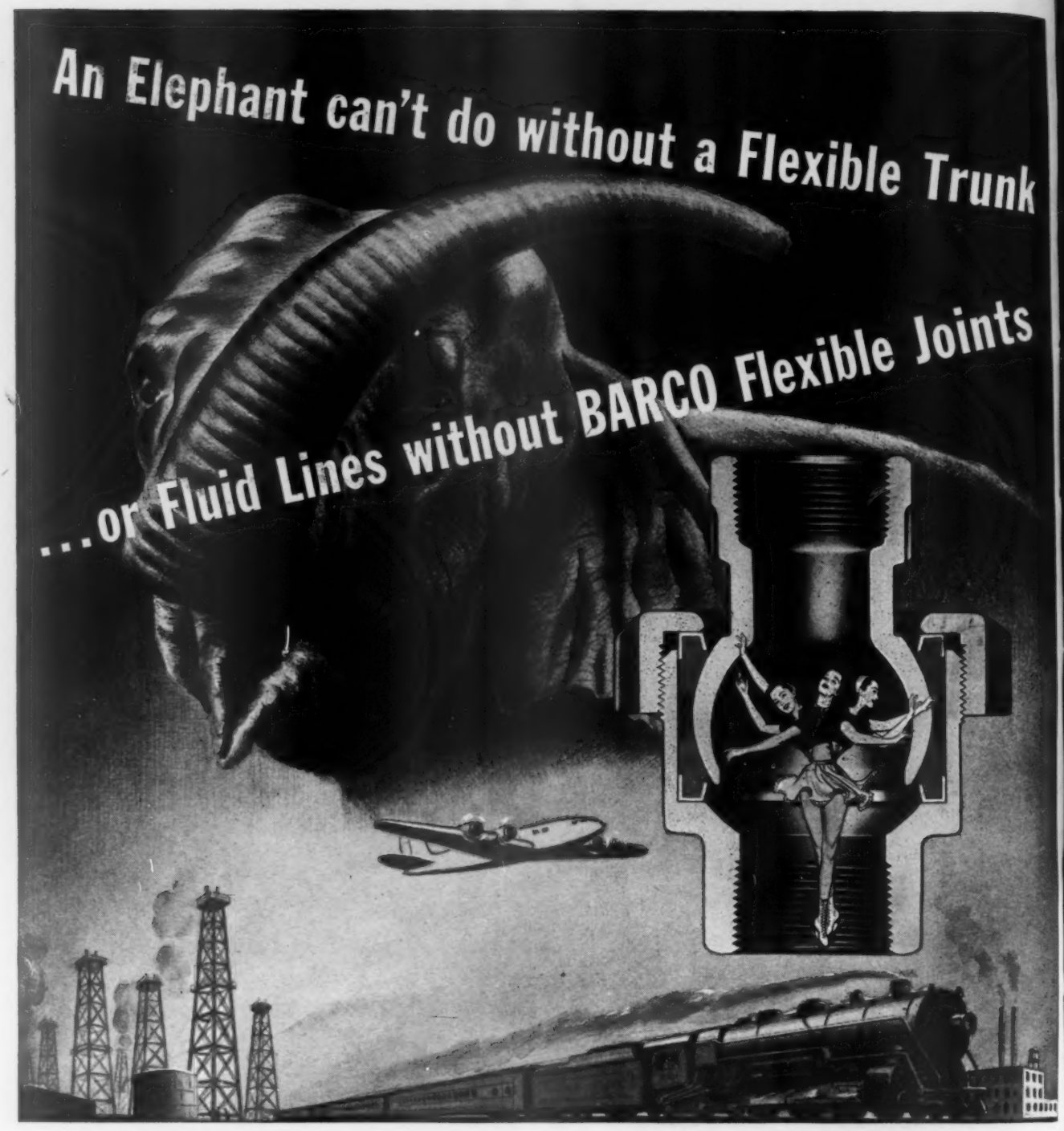
Front end netting trouble due to clogging deposits and faulty draft distribution ends with the installation of a Huron Venetian Spark Arrester. Its moving bar construction makes it self-cleaning; scientific design promotes uniform front end draft. Write for particulars.

HURON

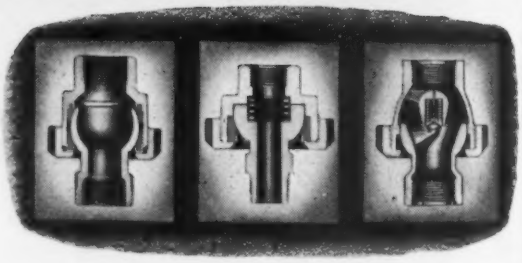
...NUFACTURING CO.
3240 E. Woodbridge St.
Detroit 7, Mich.

An Elephant can't do without a Flexible Trunk

...or Fluid Lines without BARCO Flexible Joints



Nature provides flexibility in every living, moving thing. Because there is always movement—vibration, expansion, contraction—in any fluid-conveying system, Barco Flexible Joints are needed to provide responsive, compensating movement through every angle. For over 30 years they have been accepted as the standard for such protection against strain and shock. For complete engineering information, write to Barco Manufacturing Co., Not Inc., 1808 Winnemac Ave., Chicago 40, Illinois.



BARCO FLEXIBLE JOINTS

Not just a swivel joint...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

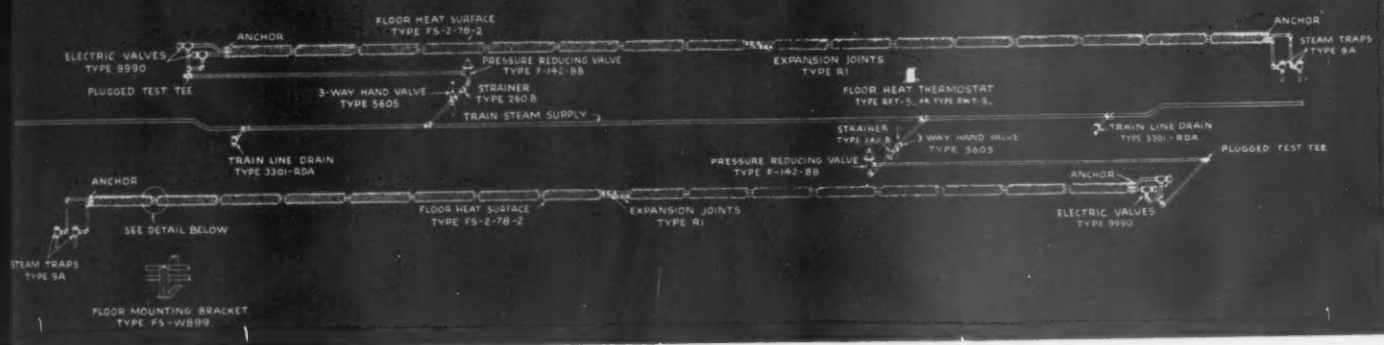
FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY

In Canada: The Holden Co., Ltd., Montreal, Canada "MOVE IN EVERY DIRECTION"

Sylphon

Heating and Air Conditioning Controls

for Simplicity*



No relays required for floor heat control.

BECAUSE the floor heat system is designed for outside temperatures of about minus 30 deg. F. —it is a problem to keep the car comfortable during the more normal winter weather.

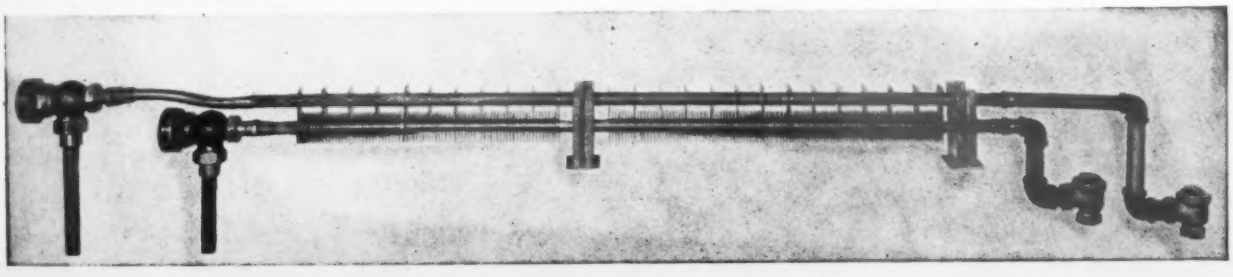
The Sylphon Control System solves this problem.

In normally cold weather only half the available capacity is used almost continuously.

Only in extremely cold weather is the total available capacity used.

In mild weather the overhead heat supply is sufficient.

This arrangement of control provides passenger comfort—by supplying continuously the amount of steam required by the car.



THE FULTON SYLPHON CO.

TRANSPORTATION CONTROLS DIVISION

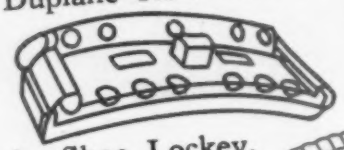
DREXEL BUILDING • PHILADELPHIA 6, PA

S in the diamond stands for

On a brake shoe, the Diamond-S trade mark is more than a mark of identification. It is a mark of value, that special value which denotes leadership and continuing progress in manufacture.

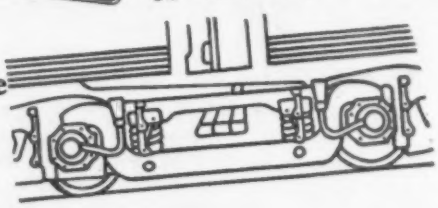
Recent milestones in Brake Shoe's railroad history include the Duplane steel back . . .

the Samson driver shoe



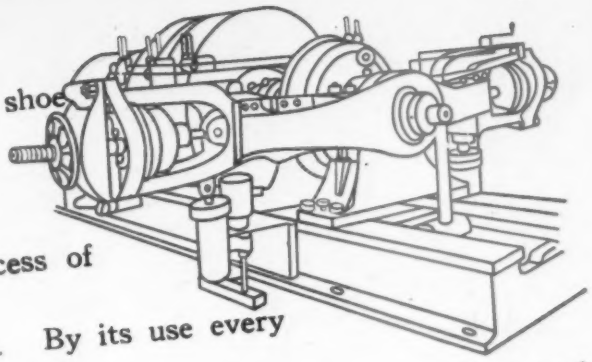
designed for more efficient service and the Brake Shoe Lockey.

A relatively new but proved device is the American Brake Shoe Controller designed by our Engineering staff to prevent slid flat wheels under passenger cars.



BRAKE SHOE AND CASTINGS DIVISION

Super-value in the brake shoe



Of special importance is the brake shoe testing machine which duplicates operating requirements far in excess of conditions encountered in service. By its use every type of brake shoe receives positive tests with actual speeds and loads reproduced. From Brake Shoe research, railroad men rightly expect future developments that will improve operations under tomorrow's higher speeds and severe demands.

AMERICAN

Brake Shoe

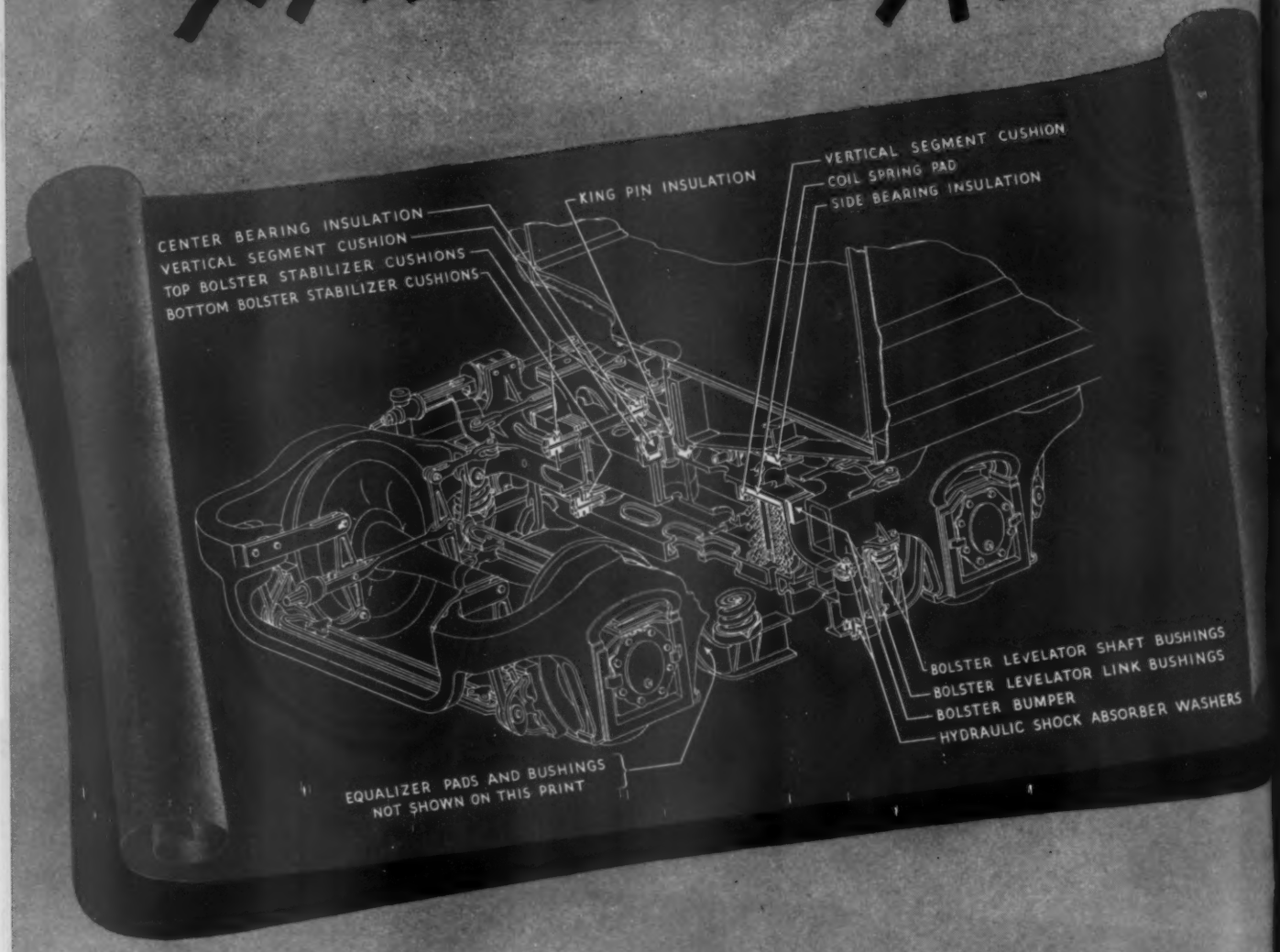
COMPANY

230 PARK AVENUE, NEW YORK 17, N. Y.

4161

Engineered Rubber

on the *Milwaukee Road*



DEAR to the heart of train-riding America are the "Hiawathas", the crack streamliners of "The Milwaukee Road."

More than 6½ million passengers have enjoyed the luxury of the Hiawathas' smooth, arrowy flights between Chicago and Minneapolis, St. Paul, Omaha, Sioux City and Sioux Falls.

Determination to make the Hiawathas the last word in comfort led "The Milwaukee Road", the designer and builder of those trains, to consult United States Rubber Company engineers.

This collaboration resulted in the introduction of rubber at strategic points to insulate the car body from the trucks and reduce the transmittal of noise and vibration created by the wheels rolling over the tracks, the movement and impact of metal parts, and the humming of generators, through rigid members of the frame into the car itself.

Center plates have rubber insulation, bolsters have cushions of rubber-bonded-to-metal at the ends, rubber bushings and washers are used; in fact, rubber is used wherever the transmission of vibration can be intercepted.

Such U.S. Rubber experience is being successfully applied in virtually every phase of transportation and industry—experience which is proving invaluable to manufacturers and their staffs.

Makes Travel Smoother

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

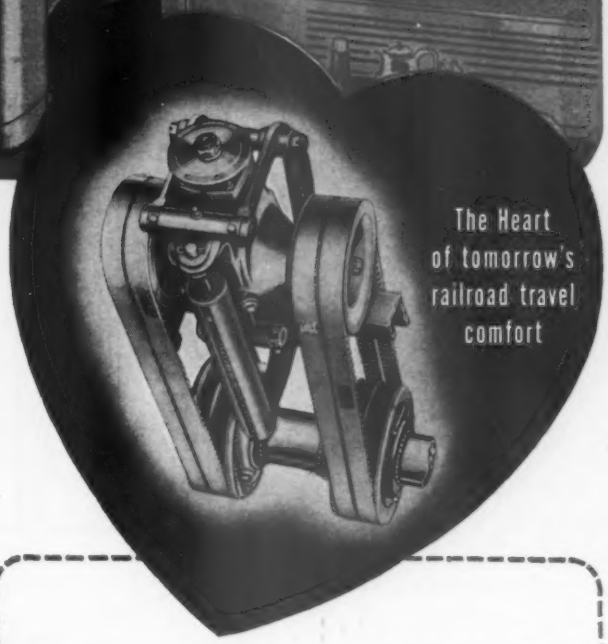
By having a small stock of "FALLS HOLLOW" STAYBOLT IRON bars in your racks, you can eliminate, once and for all, any uneasiness you may have about a shortage of hollow staybolts when those rush jobs come in. For, regardless of the type or length hollow staybolt you may require, it is simply a matter of cutting to length and threading. And remember—you will be getting all the advantages of a hollow staybolt without any drilling operations being required.

As far back as sixty years ago—long before the advent of modern high pressure power, our Company foresaw the need and necessity of hollow staybolts, realizing that the only safe staybolt is a hollow staybolt. Through all these years we have concentrated on the manufacture of this one product, with the thought ever uppermost in mind—it is better to roll the hole IN rather than to drill it OUT.

HOLLOW STAYBOLT IRON BARS
SOLID STAYBOLT IRON BARS
HOLLOW BLANK OR THREADED STAYBOLTS
SOLID BLANK OR THREADED STAYBOLTS

Since 1885

FALLS HOLLOW STAYBOLT CO.
CUYAHOGA FALLS, OHIO



The Heart of tomorrow's railroad travel comfort

The under-car drive *must* operate *ALL* of the time!

There can be no failure of the under-car drive on cars like this one. Designers of tomorrow's trains are creating railroad cars that will provide travel comforts and conveniences far beyond the dreams of a few short years ago. But they are comforts and conveniences that are placing heavier and heavier demands on under-car drives. That is why the majority of far-sighted designers are specifying Dayton "D-R" V-Belt Axle Drives. They know that Dayton drives have been in use on railroad cars for 15 years without a known case of mechanical failure due to V-Belts—one strong reason why more than twice as many air-conditioned cars are equipped with Daytons than with any other type of under-car drive. A Dayton railway specialist will make available to you the knowledge gained from these years of experience. Write today.

THE DAYTON RUBBER MANUFACTURING COMPANY
DAYTON 1 · OHIO

Railroad V-Belts by

Dayton Rubber

REG. TRADE MARK THE DAYTON RUBBER MFG. CO.

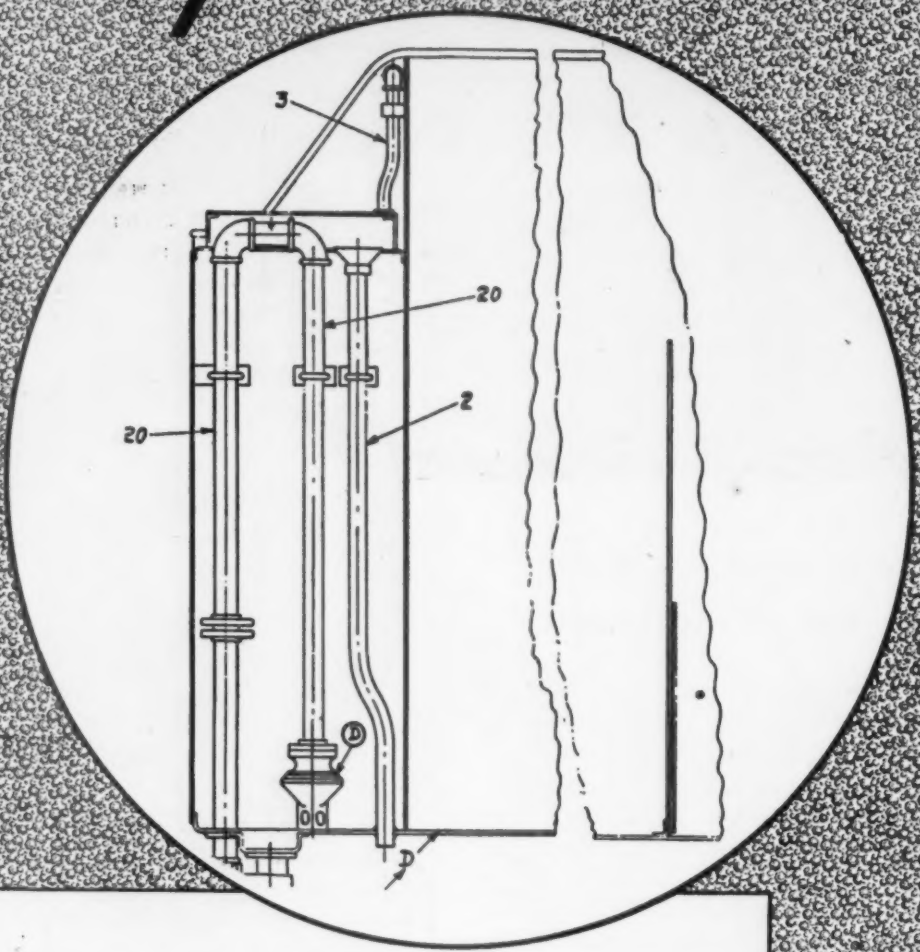
THE MARK OF TECHNICAL EXCELLENCE IN SYNTHETIC RUBBER

Advantages of the Dayton "D-R" V-Belt Axle Drive

1. *Quiet and smooth performance with high availability—in 15 years a mechanical failure due to V-Belts has never been reported.*
2. *Provides a flexible, cushioned connection between the car axle and the driven unit that protects generators and other equipment should a mechanical failure occur.*
3. *It is convenient and economical to install . . . no complicated or expensive truck changes are necessary . . . no special axles are necessary.*
4. *Duplicate equipment is not necessary to take care of emergencies—when wheel changes must be made, only the axle pulleys need to be removed.*
5. *It greatly reduces maintenance cost on mechanical equipment as well as on the drives themselves.*
6. *It imposes a minimum weight on the car axle.*
7. *It is easy and simple to install, safe and dependable in operation, and insures uninterrupted performance.*

★ 40 YEARS OF RESEARCH IN NATURAL AND SYNTHETIC RUBBER ★

FEED WATER HEATING
By Coffin



The Tender Arrangement of the Coffin Feed Water Heater System Provides

1. Open Type Heating of Feedwater
2. De-Aeration of Water.
3. Removal of Oil.

Send for Descriptive Bulletin

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

PLEASE SEND FEED WATER HEATER BULLETIN

NAME _____

COMPANY _____

ADDRESS _____

World's First Coal Burning Turbo-Electric Locomotive To be equipped with TIMKEN BEARINGS

This revolutionary locomotive is a development of the Chesapeake and Ohio Railway, Baldwin Locomotive Works and Westinghouse Electric Company. Using coal as the basic source of energy it produces steam to operate a turbine, which generates electric power to drive the wheels.

The locomotive is designed to develop 6,000 H.P. with a potential speed of more than 100 miles per hour under full load. Timken Bearings have been specified for all axles. The initial order is for three locomotives.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

RAILWAY ROLLER BEARINGS

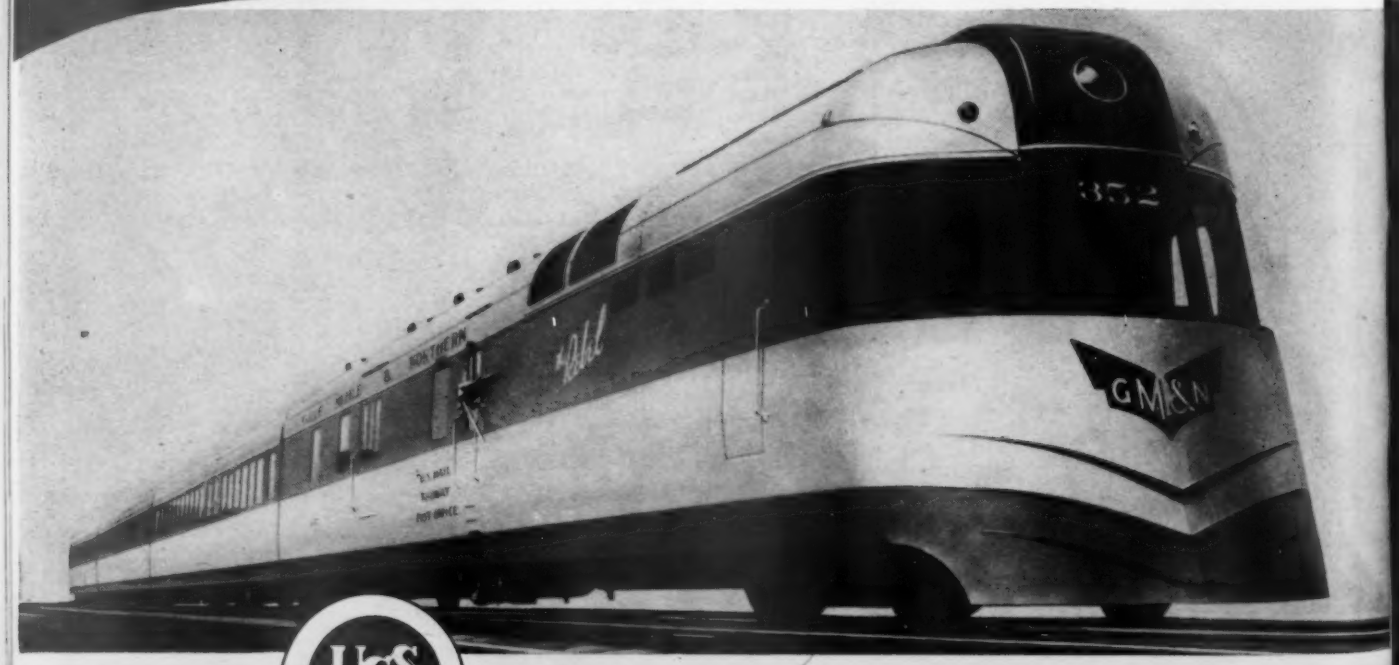
For the safe, economical reduction of

BUILT LIGHT WITH U·S·S STAINLESS STEEL

Atlantic Coast Line "Champion," typical of the many completely Budd-built trains now in service. In building this equipment, cold rolled coils, of U·S·S 18-8 Stainless Steel are passed through rolling dies to emerge as angles, channels, Z-sections, etc., which are then joined by the Budd Shotweld process into a light structure of tremendous strength.

BUILT LIGHT WITH U·S·S COR-TEN

Built by the American Car and Foundry Company for the Gulf, Mobile and Northern, the famous "Rebels" are 46% lighter than conventional construction because U·S·S COR-TEN was used to build them. The enthusiasm with which they were first received has been sustained throughout the whole period of their operation since 1935.



USS STEEL
UNITED STATES STEEL

UNITED

deadweight in passenger equipment

U·S·S Stainless Steel and U·S·S COR-TEN

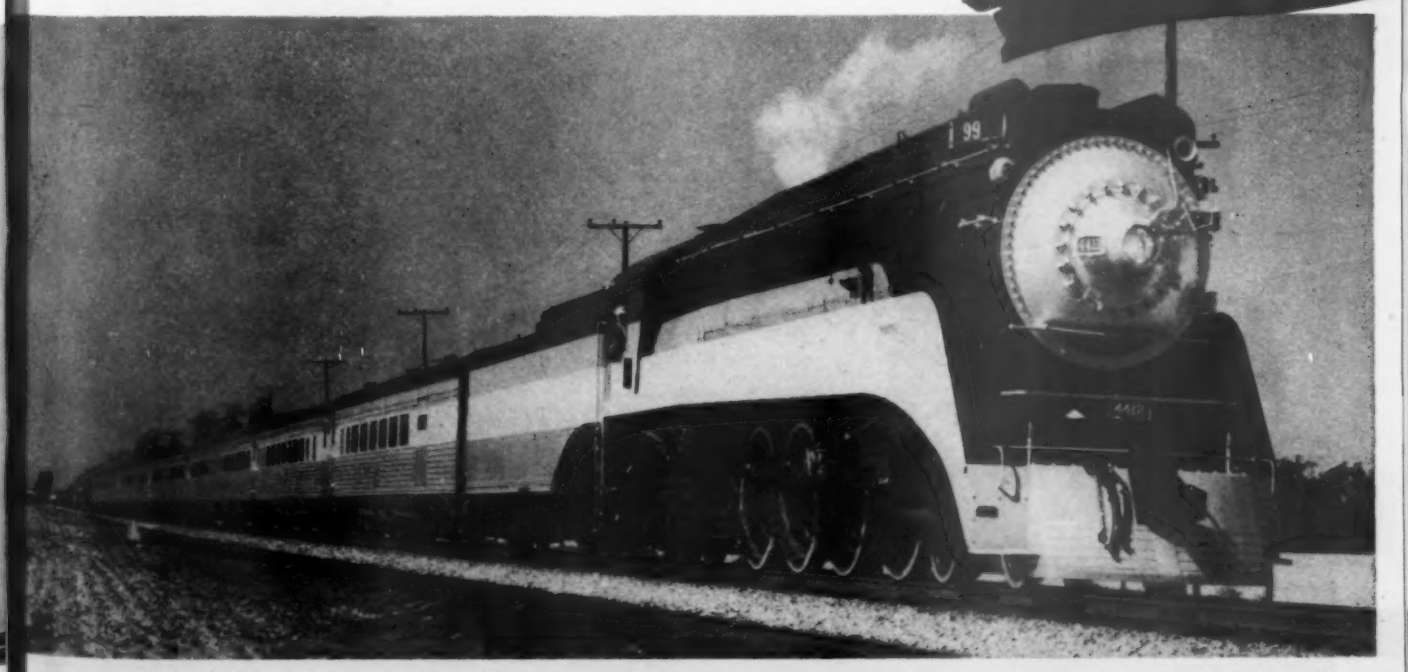
AS YOU review in your mind the famous streamliners that in ten short years have revitalized the railroads' passenger-carrying business, it is well to remember that almost 80% of them have been built with U·S·S Stainless Steel and U·S·S COR-TEN. To date more than 2,800 rail passenger units have been built lighter with these steels. Some of U·S·S Stainless only, some entirely of U·S·S COR-TEN and others using both steels.

In all these constructions, worthwhile weight savings have been accomplished. Both steels have proved highly satisfactory in service. It is on their record of demonstrated accomplishment that we recommend them for your earnest consideration.

EVERY SUNDAY EVENING, United States Steel presents *The Theatre Guild on the Air.* American Broadcasting Company coast-to-coast network. Consult your newspaper for time and station.

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Supply Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

In these ultra-modern, twin "Daylight" speedsters put into service by the Southern Pacific in 1940, a high degree of weight reduction is obtained by using U·S·S Stainless Steel sheathing and trim, with COR-TEN truss-type framing. In 94 cars, like this built by Pullman-Standard for Southern Pacific, and 64 of similar construction for service on the Santa Fe, the truss-construction of U·S·S COR-TEN has taken 220% of rated load under test.



STATES STEEL

BELIEVE IT-OR NOT

HENNESSY LUBRICATOR CO., Inc.

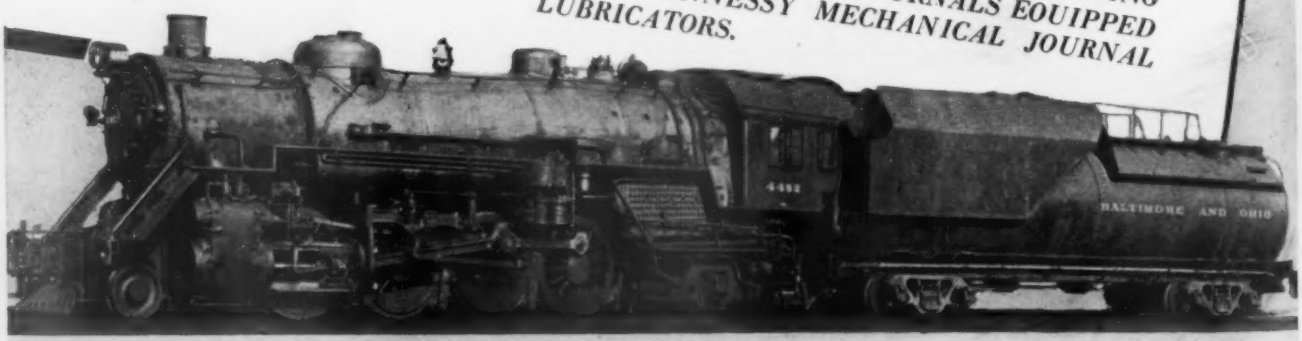
MEMO

Hennessy Mechanical Journal Lubricators installed in this 2-8-2 locomotive which averaged over 8500 miles a month during peak periods in fast freight service, accumulated 316,000 miles without requiring repairs of any kind to driving boxes, hub faces or driving journals.

The day this locomotive was delivered for service it hauled its rated tonnage from Baltimore to Chicago without any preliminary break-in period, and remained continuously available for 4 years and 10 days.

Then Class 4 repairs disclosed only 2 loose crown bearings, and no journals required turning.

Baltimore & Ohio No. 4482—rebuilt at Mt. Clare Shops, delivered for service March 5, 1941, shopped for Class 4 repairs March 15, 1945. ENGINE TRUCK, DRIVING AND TRAILER TRUCK JOURNALS EQUIPPED WITH HENNESSY MECHANICAL JOURNAL LUBRICATORS.



BY DELAYING SHOPPING FOR RUNNING GEAR REPAIRS INDEFINITELY • THUS MAKING POSSIBLE A TREMENDOUS INCREASE IN CONTINUOUS LOCOMOTIVE MILEAGE • HENNESSY MECHANICAL JOURNAL LUBRICATORS ARE DOING MORE TO INCREASE OVERALL AVAILABILITY OF MOTIVE POWER THAN ANY OTHER RECENT STEAM LOCOMOTIVE DEVELOPMENT.

HENNESSY LUBRICATOR CO., INC.
75 WEST STREET NEW YORK 6, N. Y.

PASSENGER CAR *Wear Parts*

Enduring riding comfort is assured when passenger cars are equipped with Rol-Man Pins, Bushings and Wear Plates. They last so long, with imperceptible wear, that "jarless" riding and "joltless" starting continue for many, many miles longer than normally expected.

Even if Rol-Man Wear Parts cost more, they would deserve a place in new or rebuilt cars, but they don't. They cost less per mile. No metal or alloy has yet been discovered to equal the combined high wear resistance and strength of Rol-Man Manganese Steel. And Rol-Man processing methods insure the ultimate, inherent qualities of high manganese steel.

Send us your prints and specifications for a quotation. Try Rol-Man and see how much you get for so little.

MANGANESE STEEL FORGE CO.,
2813 Castor Avenue, Philadelphia 34, Pa.

PEDESTAL & JOURNAL BOX WEAR PLATES

BOLSTER & TRANSOM CHAFING PLATES

BRAKE RIGGING PINS AND BUSHINGS

SWING HANGER PINS AND WEAR PLATES

DRAFT GEAR & COUPLER WEAR PARTS

CENTER AND SIDE BEARING WEAR PLATES

ROL-MAN

Rol-Man Pins and Bushings are ground to precision diameter. Wear plates are fabricated to your specifications, ready for installation.

PINS • BUSHINGS • WEAR PLATES

MILLERPAX...

JOURNAL BOX PACKING WASTE

The excellent service achieved by MILLERPAX Journal Box Packing Waste is due to the extensive research prior to manufacture, care and thoroughness in manufacture and to the fact that the waste threads are interwoven.

Interwoven MILLERPAX is designed to eliminate waste grabs, waste wipes and rolling of the packing in high-speed train service. In this respect MILLERPAX has been highly successful on one of the larger railroads where it has been in use for over a year. MILLERPAX is available in either all wool, all cotton, or any combination of the two packings.

MILLERPAX — Registration applied for
Manufacturing Process — Patent Pending.

MILLER WASTE MILLS, INC.

WINONA, MINNESOTA

NASH-FINCH CO., Minneapolis - Exclusive Railroad Sales Representative

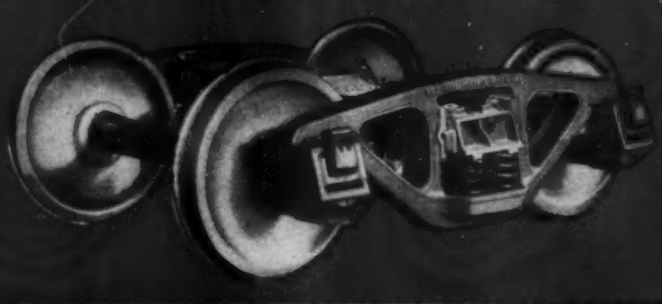
Lading gets an easy ride in cars equipped with A.S.F. Ride-Control Trucks. All bolster motion is constantly controlled, and long-travel springs provide ample reserve spring travel for cushioning dynamic shocks at all speeds under full load.

MIST-MARK OF ○ FINE CAST STEEL

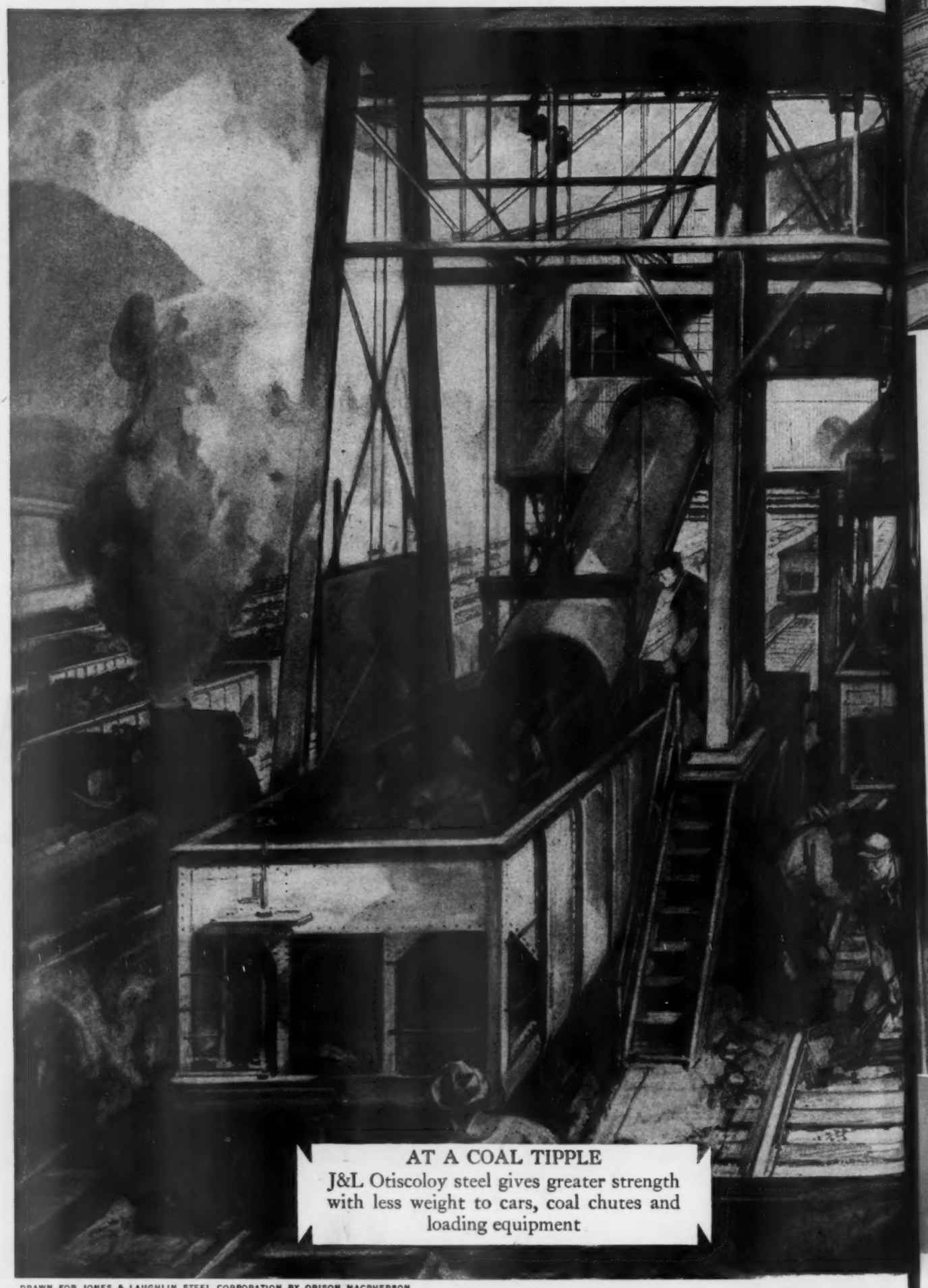
Over 17,000 car sets of this modern freight car truck are already in service or on order by 43 railroads and private car owners.

A-S-F *Ride-Control* TRUCK (A-3)

NO SPRING PLATES—NO SPRING PLANKS



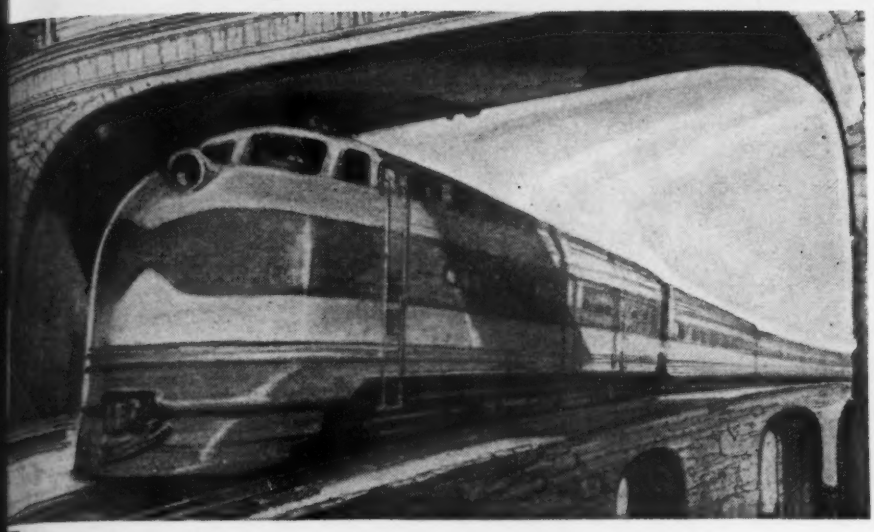
AMERICAN STEEL FOUNDRIES



AT A COAL TIPPLE

J&L Otiscoloy steel gives greater strength with less weight to cars, coal chutes and loading equipment

DRAWN FOR JONES & LAUGHLIN STEEL CORPORATION BY ORISON MACPHERSON



MORE PAYLOAD....LESS DEADWEIGHT ....LONGER LIFE

WITH J&L HIGH-TENSILE

OTISCOLOY STEEL

In the large and diversified family of J&L controlled quality steels, Otiscoloy is the low-alloy, high-tensile member that serves widely and well where reduction in structural weight, without loss of strength, is a factor.

A field in which this is highly advantageous is transportation where unnecessary deadweight is a constant charge against revenues and where its reduction is reflected in increased payloads.

On account of its greater strength and lighter weight, Otiscoloy reduces deadweight by 25%. It also lengthens the life of equipment from four to six times by its resistance to atmospheric corrosion and by its greater resistance to abrasion. To the manufacturer of transportation equipment, Otiscoloy steel offers an easily workable material, for it can be readily formed, either hot or cold, on present-day presses and has excellent weldability.

For all ingenious engineers and fabricators, Otiscoloy is a spark to the imagination, a spur to the conversion of blue prints into new products of steel that are strong, light and lasting.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

J&L STEEL

LIGHTER, STRONGER, CONTROLLED QUALITY STEELS

COPYRIGHT 1945. JONES & LAUGHLIN STEEL CORPORATION

LIGHT & STRONG

Steel freight cars and passenger cars are now being built by thousands. Many will be constructed of Otiscoloy, a special, lightweight steel developed by J&L that has great strength, workability, weldability, and assures gains in the payload up to 25%.

Otiscoloy (pronounced O-*tis*-co-loy) was developed in and named for J&L's Otis Works, Cleveland. This special steel is also produced in other J&L works as continuous sheets and as bars of varied forms.

Coal still king on R.R.'s as biggest, cheapest source of primary energy for locomotive power. Through Bituminous Coal Research, Inc., several big rail carriers are conducting research toward development of (a) gas turbine locomotive using coal as basic fuel, and (b) high-powered steam turbine-electric locomotive, burning coal.

When you compare watches with train conductor, his is correct, for it must be kept within 30-second variation per week.

"Riding the gravy train," an expression that may lack elegance, aptly describes the gain in revenues enjoyed in the operation of trains made up of equipment fabricated from Otiscoloy, the J&L high-tensile steel that reduces deadweight by 25%. In an average hopper car the saving Otiscoloy affords gives a net gain in the payload of 11,000 pounds, or 5½ tons. In a 100-car train, this amounts to some 550 tons, which is quite a ladleful of "gravy" in revenue.

R.R.'s carry 72% of ton-miles handled by all carriers, including water, motor, pipe line and air.

Europe needs million freight cars, American army transportation experts estimate, many thousands of which will be constructed of light, strong, high-tensile American steels.

"T"-rail, hook-head spike, fish plate were invented in 1830's by Robert L., son of John Stevens, builder of 1st U. S. locomotive.

½ ton more pay freight can be hauled when you operate a large truck made from Otiscoloy, for this is the average saving afforded by this J&L high-strength steel.

Brake wheel frames on every great bomber in our huge sky fleet and on many other of our fighting aircraft, were made of Otiscoloy, to save weight and add strength.

When bumpers were just leaf springs, their simple shape made processing easy. They were hot formed, ground and polished, then plated. However, the hot forming process became complicated when deeper, more intricate bumpers with end extensions were made. The spring steel distorted noticeably on cooling, requiring more grinding and hand work before plating. As a result, companies designing cars with heavier bumpers began to look around for stronger, lighter, more workable steel, such as Otiscoloy, and the trend toward high-tensile steels for this use seems assured.

(Advertisement)

Stop using

That's what happens in average freight traffic today. The deadweight of freight cars equals the weight of their pay load—hence, half of the power is consumed in moving non-paying deadweight.

Suppose you could reduce the weight of your freight car bodies by 25%. You'd have less deadweight to haul—and that much more capacity for paying freight.

And you can do it by using Republic High Strength Steels *throughout* your freight car bodies. 10 years of experience has proved it.

In order that car designers and builders may obtain maximum results, Republic now offers you three *different* high strength steels from which you can select the one best suited to your particular requirements—Republic ALDECOR, Republic COR-TEN and Republic DOUBLE STRENGTH.

These three weight-saving steels provide a minimum yield strength of 50,000 pounds per square inch which, combined with essential resistance to atmospheric corrosion, permits the use of thinner and smaller sections without sacrifice of service life. Because of certain variations in

half of your power

PULL DEADWEIGHT

other properties, one of these steels probably will meet a specific need more efficiently and economically than either of the other two.

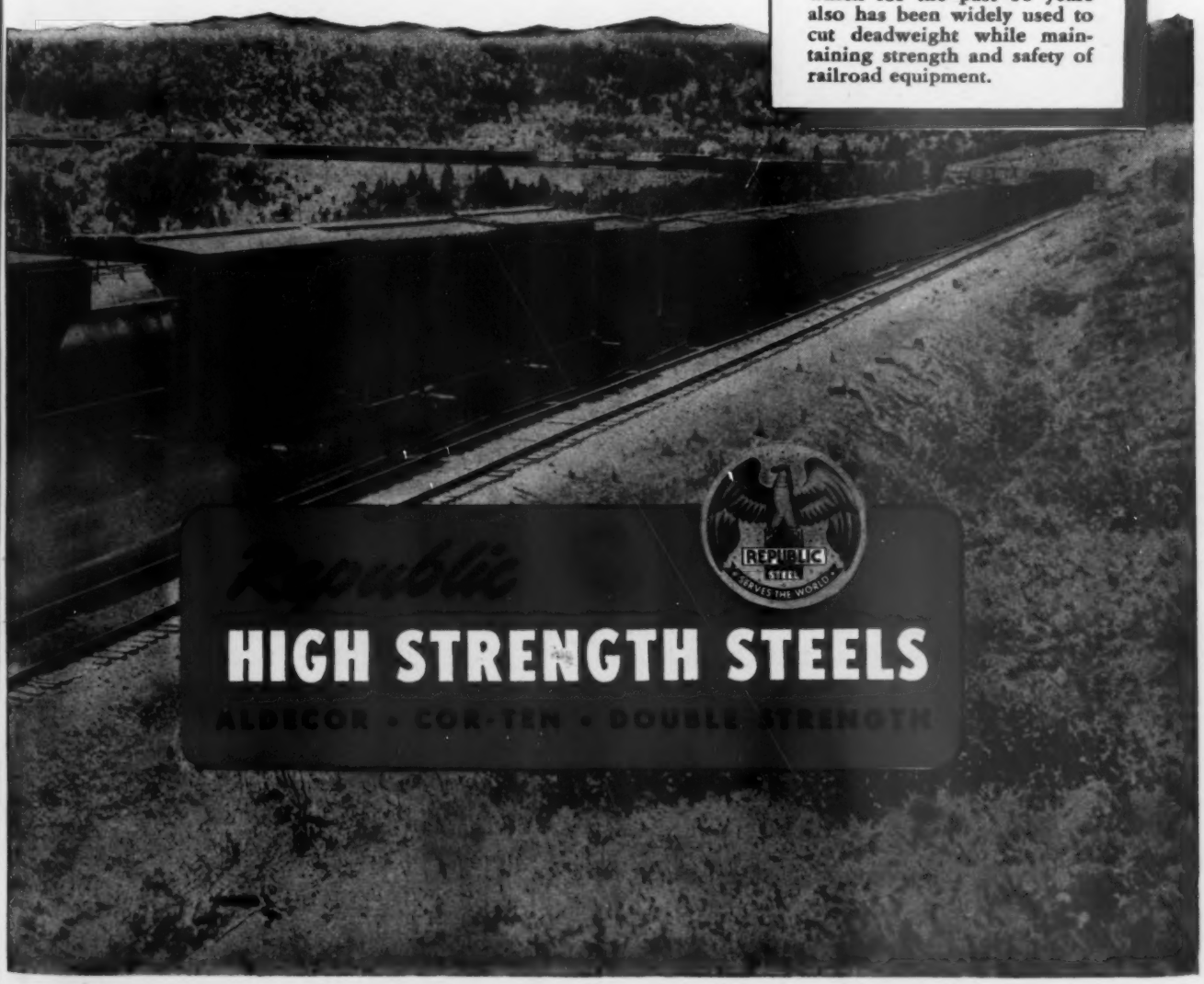
Thousands of new freight and passenger cars are needed to replace those too cumbersome and obsolete for profitable service. Make sure your new cars are profit-producers—free from excess deadweight—capable of carrying more pay load—able to take rough service "on the chin"—and low in maintenance costs—by specifying Republic High Strength Steels.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC ALDECOR
The latest development in high strength steels—the result of experience gained in ten years of high strength steel production and application—and possessing superior welding and forming characteristics.

REPUBLIC COR-TEN
Now celebrating the tenth anniversary of equipment made from it, COR-TEN has proved itself to be a dependable weight-reducing material for all types of railroad rolling stock.

REPUBLIC DOUBLE STRENGTH
A low-cost, high strength steel which for the past 10 years also has been widely used to cut deadweight while maintaining strength and safety of railroad equipment.



DOING THE JOB BETTER

motor wheel journal box lids

THE REASON? — precision manufacture — proven design — best of materials — millions in service — freight and passenger —**The best lid for any service.**

The Above Equipment Fully Meets A. A. R. Requirements

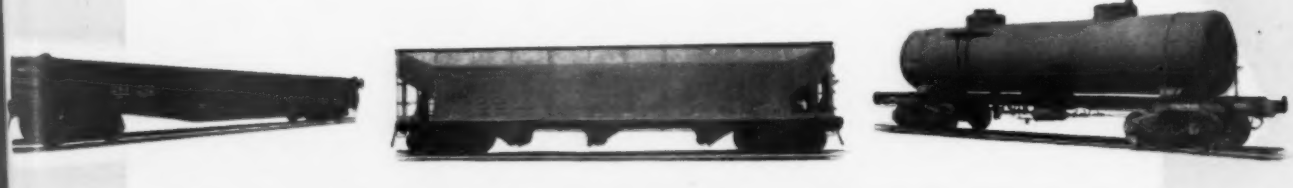
T-Z RAILWAY EQUIPMENT CO., Inc.

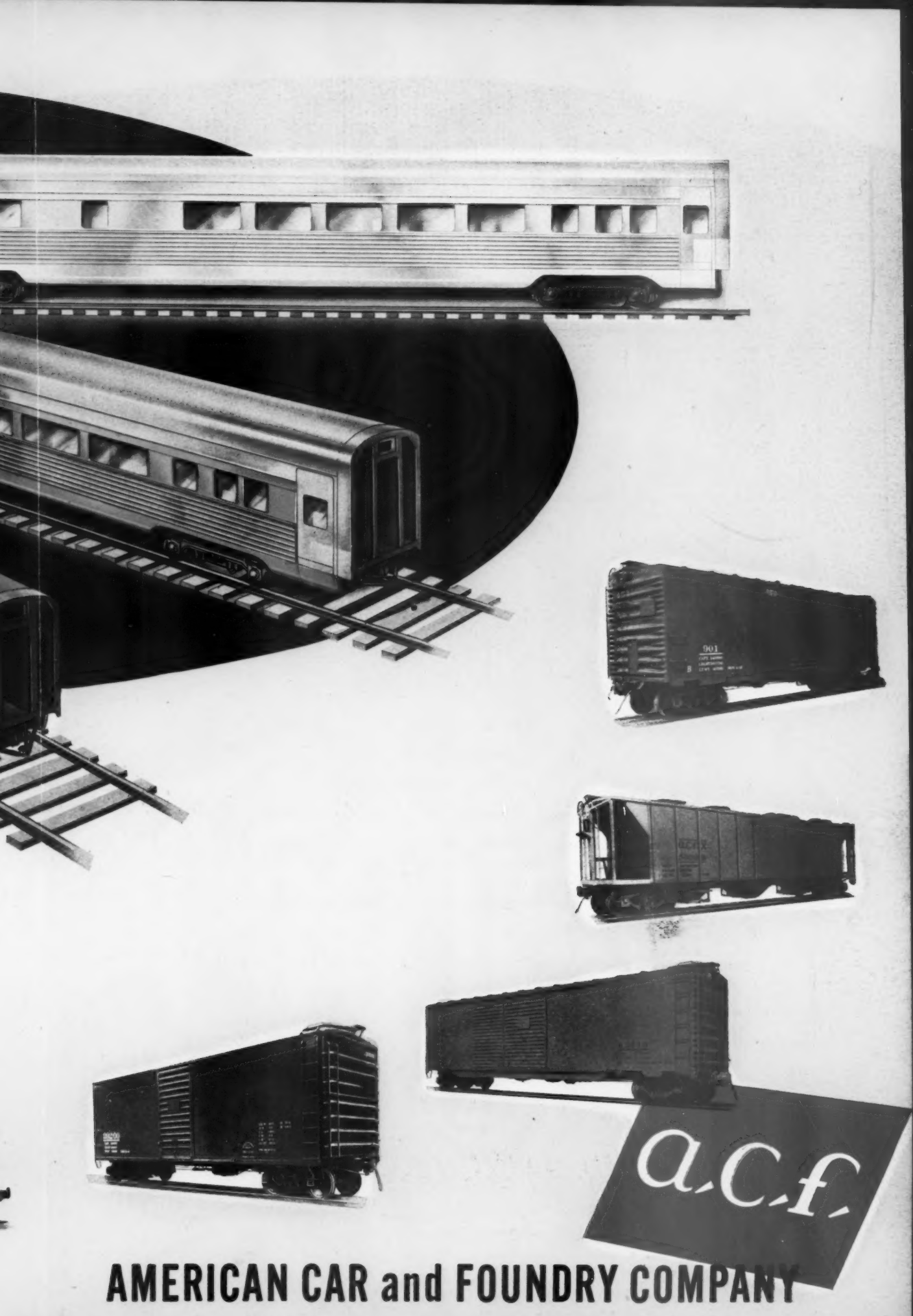
8] SO. MICHIGAN AVENUE **CHICAGO 3, ILLINOIS**

National Railway Sales Representative ***Motor Wheel Corp., Lansing 3, Mich.***

UNSURPASSED revenue-producing PERFORMANCE over countless millions of miles is a potent reason why rolling stock built by Q.C.f. invites primary consideration of railway mechanical engineers and management.

Whether your needs are the design and construction of the most advanced streamliner or commuter coach . . . lighter freights to travel at faster speeds . . . structurally stronger, welded tank cars . . . or special tools such as the Q.C.f. wheel tread grinder to maintain wheel concentricity — look to Q.C.f. for the men, methods, materials. Years of building MORE rolling stock means building MORE into rolling stock for years!





AMERICAN CAR and FOUNDRY COMPANY

* 2,000,000

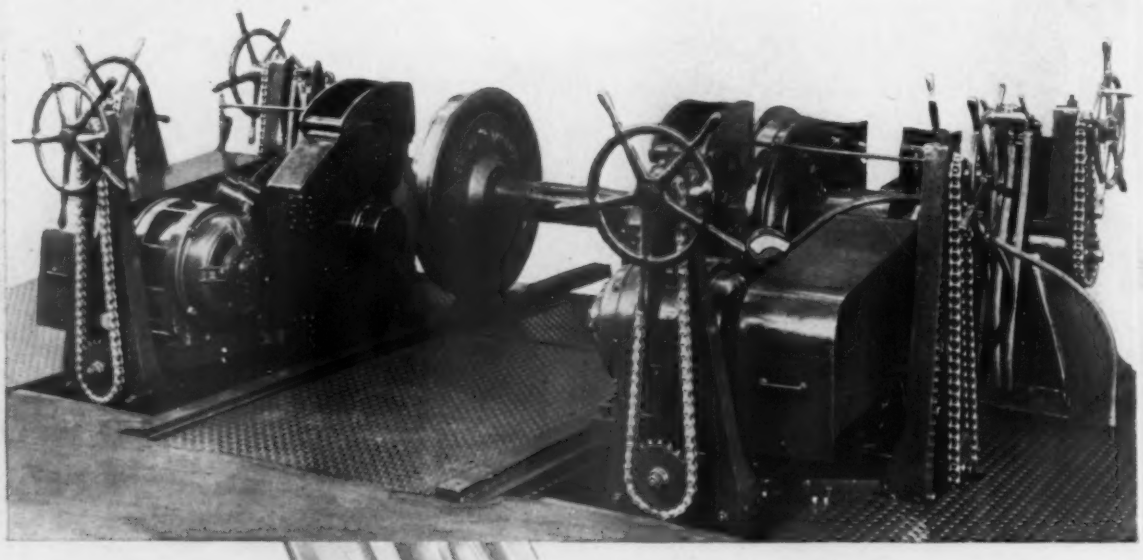
a.C.f. BUILT CARS

are their own best salesmen!

* ACTUALLY, SINCE THE PRESENT COMPANY WAS FORMED IN FEBRUARY, 1899, MORE THAN 2,000,000 CARS HAVE *DELIVERED THE GOODS.*

A.C.f. Chilled Car Wheels are made to exacting standards and inspected before shipment by the Association of Manufacturers of Chilled Car Wheels.

Treat any pair of wheels to perfectly concentric treads by precision grinding with an A.C.f. High Speed Wheel Grinder. Grinding is the final "policeman" for boring, mating and mounting, as well as a corrective for eccentricity resulting from these operations.



a.C.f. AMERICAN CAR and FOUNDRY COMPANY

NEW YORK • CHICAGO • ST. LOUIS • CLEVELAND • WASHINGTON
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Whatever a.C.f. *builds—it is known to build well!*

SUPERIOR CAR DOORS are *LIGHTWEIGHT* DOORS

22% lighter

Superior Car Doors are approximately 22% lighter . . . with no decrease in strength.

They are doing their part toward light-weight construction . . . their saving in dead weight permits increased pay-load.

SUPERIOR CAR DOORS

- RIGID CONSTRUCTION
- LIGHT WEIGHT
- LONG LIFE
- WEATHER PROOF
- FREE ROLLING
- NO SLAMMING

SUPERIOR CAR DOOR COMPANY, McCormick Building, CHICAGO

ARE YOUR LOCOMOTIVES HAULING
A WHITE ELEPHANT
Why make your locomotives haul "a white elephant"—a passenger cooling system that piles on an extra and unnecessary load? Steam, axle or electrically driven systems are power parasites. Ice activated systems are weighty, wasteful and expensive.
The Waukesha Railway Ice Engine imposes no power drag or additional load upon the locomotive. Independently powered, propane fueled . . . it insures continuous, uniform, modulated cooling . . . anytime, anywhere regardless of train movement or car location. No power line! No steam connections! No ice!
Send for complete details on the Waukesha Ice Engine for initial or conversion installation.
REFRIGERATION DIVISION
WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN

10 Years Operation

have TESTED and PROVED IT!

WAUKESHA

ENGINE-DRIVEN *Equipment*

In 1935, one railroad started operating one coach with Waukesha engine-driven equipment . . .

And *Railway Age* in its Sept. 14, 1935 issue carried an article about it, headed "Air Conditioning with No Locomotive Power Drag" . . .

That was in the beginning—ten years ago. Waukesha was making but one railway product then—the Waukesha Ice Engine. It supplied air conditioning only—and was used about six months in the year.

But—right from the very start—it was an exceptional success. More than 25 of America's major railways have found its advantages and savings remarkably outstanding!

Waukesha did not stop there. The same Waukesha principles were applied . . . and their application extended . . . to replace the axle-driven generator with the Waukesha Engine-Generator.

The comfort cycle is complete. Full voltage illumination by the Engine-Generator—and full car cooling capacity, both proportioned to demand by modulation—*automatically* at all times.

No parasite power drag on the locomotive! No terminal standby service required. Entirely independent of train movement, car location, or the locomotive itself!

Your new equipment plans should include the Waukesha Comfort Twins. Send for Bulletins 1114 and 1179.

REFRIGERATION DIVISION

WAUKESHA MOTOR COMPANY • WAUKESHA, WIS.

LARGEST BUILDERS OF MOBILE ENGINE-DRIVEN REFRIGERATION AND GENERATOR EQUIPMENT

FOR LOWEST COST PER YEAR OF SERVICE LIFE

—no other material can equal ALLOY STEELS

You just can't beat alloy steels for length of service life. They continue their superior performance under adverse conditions long after ordinary steels have worn out or failed.

That's why they cost less per year of service life, even though their first cost may be higher than that of less efficient grades of steel. And that's why you should use alloy steels for locomotive side rod blanks, as shown above, and for pins, bolts, slides and other vital operating parts of railroad equipment.

Alloy steels have other qualities which recommend them for your use, too. Their high strength-to-weight ratio permits the use with safety of lighter equipment and smaller sections. Their super-toughness provides protection against severe shocks, reversal of stresses or overloading. Their uniform hardness means reduced wear. And their resistance to fatigue, heat, cold and corrosion further adds to service life.

Republic—world's leader in the production of alloy steels—is ready NOW to assist you in the most efficient and most economical application of these fine steels. Write to—

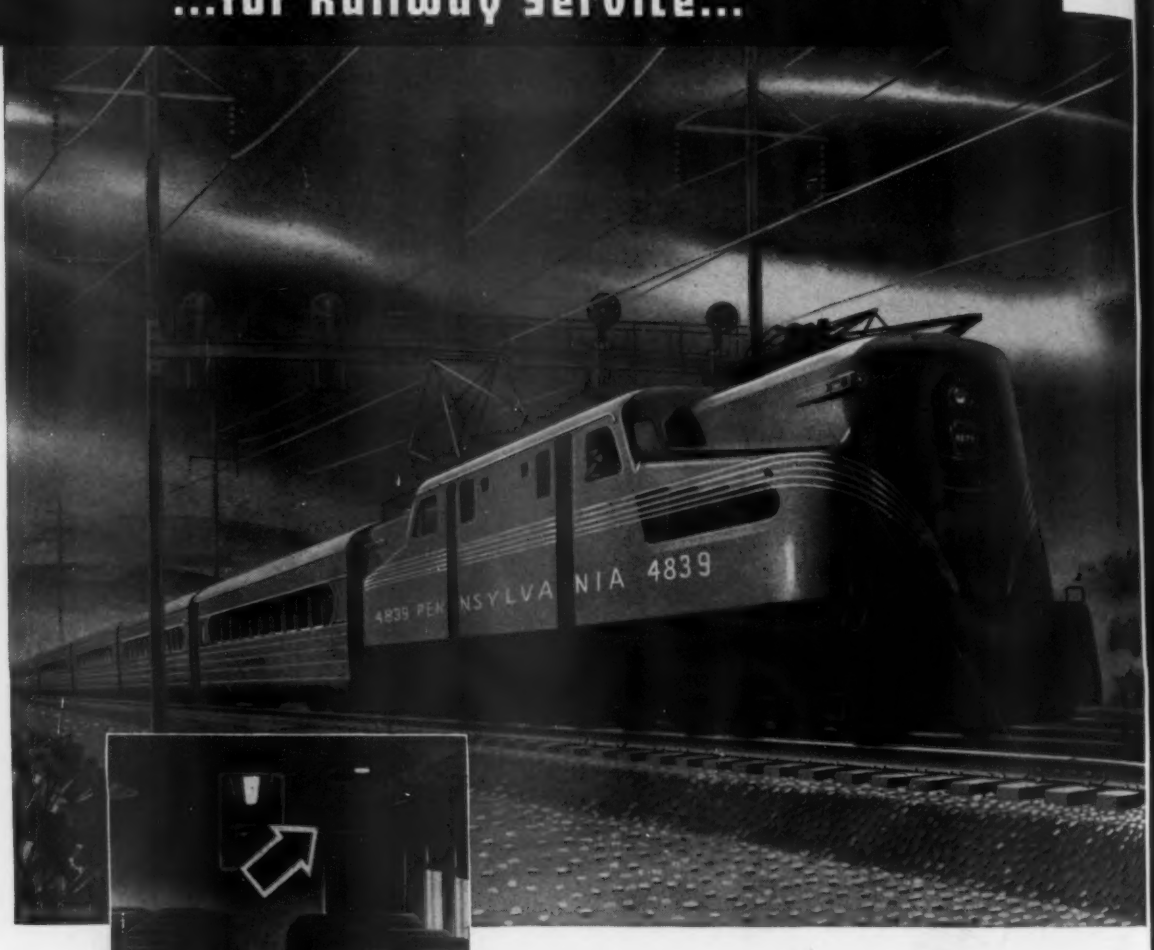
REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Bldg., New York 17, N. Y.

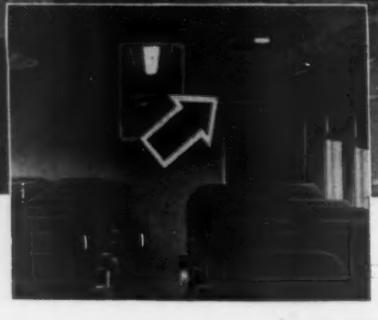
Republic ALLOY STEELS

Also Carbon and Stainless Steels—Sheets—Plates—Pipe—Upson Bolts, Nuts and Rivets—Electrunite Boiler Tubes

BARBER-COLMAN GRILLES

...for Railway Service...

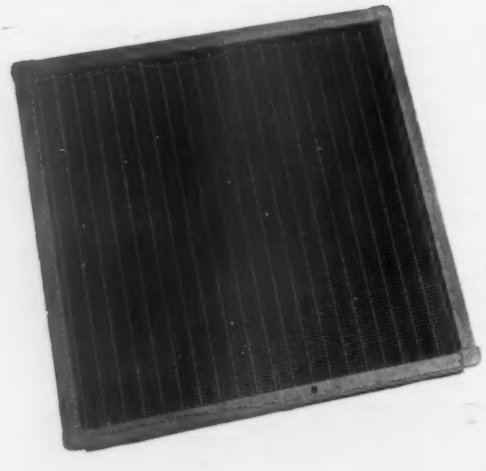




Passageway view shows the location of the Barber-Colman Return Air Grille.

PENNSYLVANIA'S STREAMLINED TRAIL BLAZER USES *uni-flo* GRILLES

AN important item in the air conditioning system on the coaches of the Pennsylvania Railroad's popular Trail Blazer is the Barber-Colman return air grille. It is located in the passage as shown. The unit is fabricated with an integral filter box, hinged so that it can be conveniently cleaned, and filters replaced when necessary. Barber-Colman UNI-FLO Railway Grilles are fabricated of sheet steel. The core construction is rigid. The fin strips are folded and have pressed-in support bars to give a firm interlocking assembly. Write for data.



The Barber-Colman Return Air Grille used in the Pennsylvania *Trail Blazer* coaches. Note the fin construction and support bars. The unit is rigid, rattleproof, and easy to clean.

BARBER-COLMAN COMPANY
Rockford, Illinois

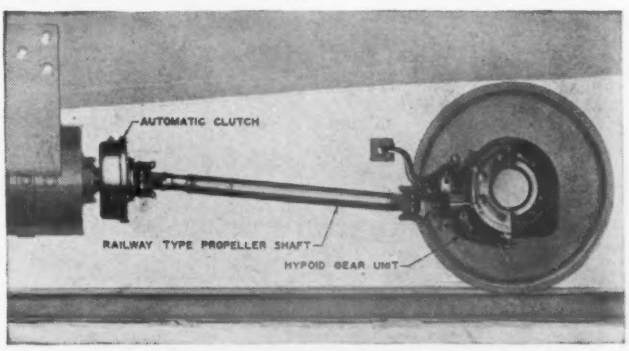
Here's another crack American train using the many efficiency advantages of the Spicer Positive Generator Drive. It's a New York, New Haven and Hartford Railroad streamliner, and it's one of the more than 2000 Spicer Drive installations used by 27 different railroads all over the country.

The Spicer Positive Generator Drive will help you solve many of the service and comfort requirements of tomorrow's railway travel.

The modernization of existing cars, and the development of new cars incorporating high standards of passenger comfort, will require increased and more dependable electrical power to operate satisfactorily with the expanded use of air conditioning, improved lighting, electro-mechanical water coolers, radio, electric kitchen equipment, etc., and other improvements to come. Cars will operate generally at higher speeds and will be much quieter and smoother. All of these are factors emphasizing the importance of using a reliable generator drive.

The simple means of applying the Spicer Drive makes it readily adaptable to both old and new cars with few, if any, changes necessary in the car, truck or axle construction.

Other Spicer features include high efficiency and economy, safety, quietness and smoothness. Write for full details and literature describing *all* the profitable advantages Spicer Positive Generator Drives make available to you.



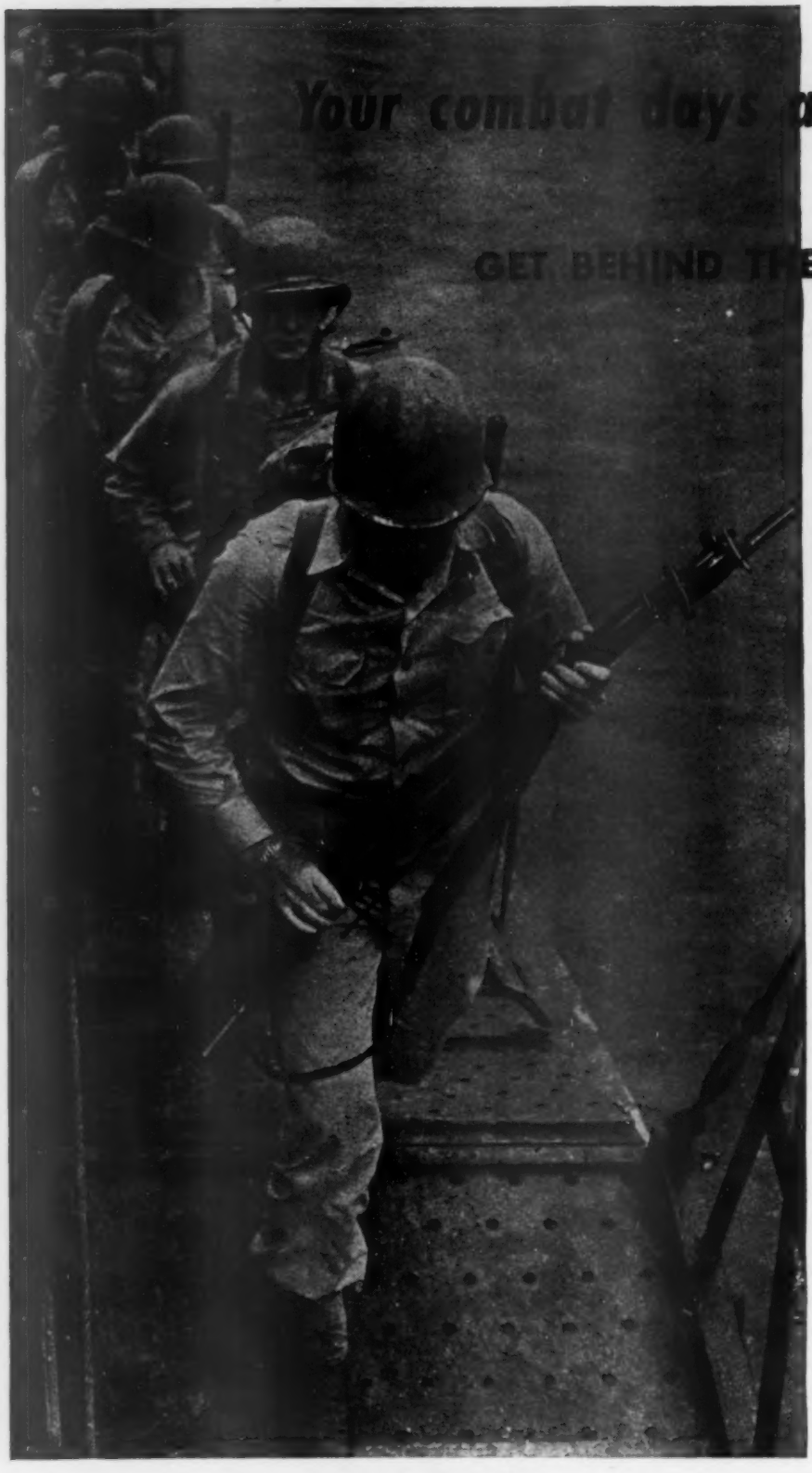
Exterior and cross-section view of Spicer Positive Generator Drive

SPICER *Positive* Generator Drive

Manufactured, Sold and Serviced by

Spicer Manufacturing Corporation, Toledo, Ohio

42 YEARS OF **Spicer** SERVICE



VICTORY LOAN!

There's plenty of action ahead for fast-thinking industrial leaders in putting over the new Victory Loan! Your Victory drive is important because:

EVERY VICTORY BOND HELPS TO

1. Bring our boys back to the America for which they were willing to give their lives!
2. Provide the finest of medical care for our wounded heroes!

BOOST THE NEW F. D. ROOSEVELT MEMORIAL $200 BOND!

Urge all your employees to buy this new Franklin Delano Roosevelt Memorial $200 Bond through your Payroll Savings Plan! At all times better than ready cash, Victory Bonds are industry's "Thanks" to our returning heroes!

START YOUR VICTORY DRIVE TODAY!

Every Victory Bond aids in assuring peacetime prosperity for our veterans, our nation, your employees—and your own industry!

The Treasury Department acknowledges with appreciation the publication of this message by

VICTORY LOAN

RAILWAY MECHANICAL ENGINEER

★ *This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council* ★

COVERED HOPPER CARS ARE DOING MORE JOBS EVERY DAY

OUR SPECIALLY DESIGNED ROOF FOR THIS TYPE OF CAR WILL PROVIDE THE SAME WEATHERPROOFING PROTECTION THAT HOUSE CARS OBTAIN WITH IMPROVED SOLID STEEL ROOFS.

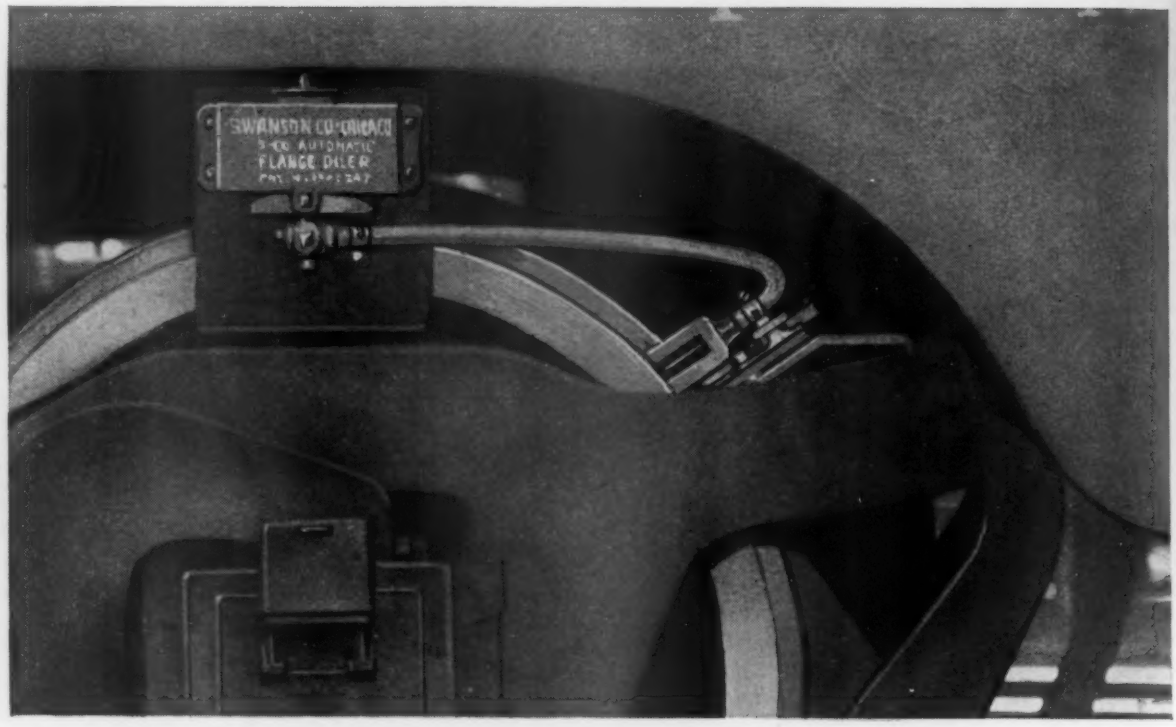
STANDARD RAILWAY EQUIPMENT MFG. COMPANY

HAMMOND, INDIANA

WORKS: HAMMOND, INDIANA — NEW KENSINGTON, PA.

CHICAGO OFFICE—310 S. MICHIGAN AVE.

Diesel AVAILABILITY Increased



Swanson Flange Oiler Installed on Diesel Switching Locomotive

Thousands of SWANSON Flange Oilers are in use on over 100 roads.

Less shop time for wheel maintenance is the history of diesel switchers equipped with SWANSON Flange Oilers.

SWANSON 100% Automatic Flange Oilers are specifically designed to lubricate the flange correctly. These oilers are simple and sturdy in construction, requiring practically no attention except filling. The SWANSON Oiler works only when the locomotive is in motion with the wiping action of the oiling shoe confining the lubricant to the flange alone.

You can greatly increase the life of flanges and reduce the number of derailments by installing SWANSON FLANGE OILERS.

We manufacture flange oilers suitable for all types of diesel switchers and steam locomotives

THE SWANSON COMPANY

2522 W. Lawrence Ave. **Chicago 25, Ill.**

THAT'S WHY your NEW air-conditioning equipment will do more but weigh less!

The new Sturtevant Air Conditioning Equipment has been designed to keep pace with modern car construction—where tough, lightweight metals are used to eliminate every possible ton of unnecessary weight. You know too well that dead weight can't be written off as "relatively" small. No matter how small, it calls for its own definite fuel requirements. There are no free loads hauled—they are either paying their way —or "dead heads".

To prove our point, look at the Sturtevant Compressor-Condenser unit—total weight less than 1900 pounds! The complete compressor comes to less than 300 pounds! The new Divided-Fan-Evaporator, fittings and all, totals slightly under 550 pounds.

And for all of its important weight reductions, you get the improved performance and efficiency of flexible, continuous, low-power operation . . . the stability of a split system that maintains temperature and humidity uniform—eliminates the "too hot" and "too clammy" intervals common to most equipment.

OTHER "INTEGRATED" UNITS

Improved Sturtevant Equipment for combining into new systems or replacing units in existing ones include: the Dry Surface Condenser, the Motor-Compressor Unit, and the Evaporative Condenser Unit that uses a water spray.

Whether your plans call for a mechanical or ice-activated system, complete air conditioning or pressure ventilation, it will pay you to look to Sturtevant. Our Engineers are ready to show you how to blueprint these profit boosters into your present or proposed equipment.

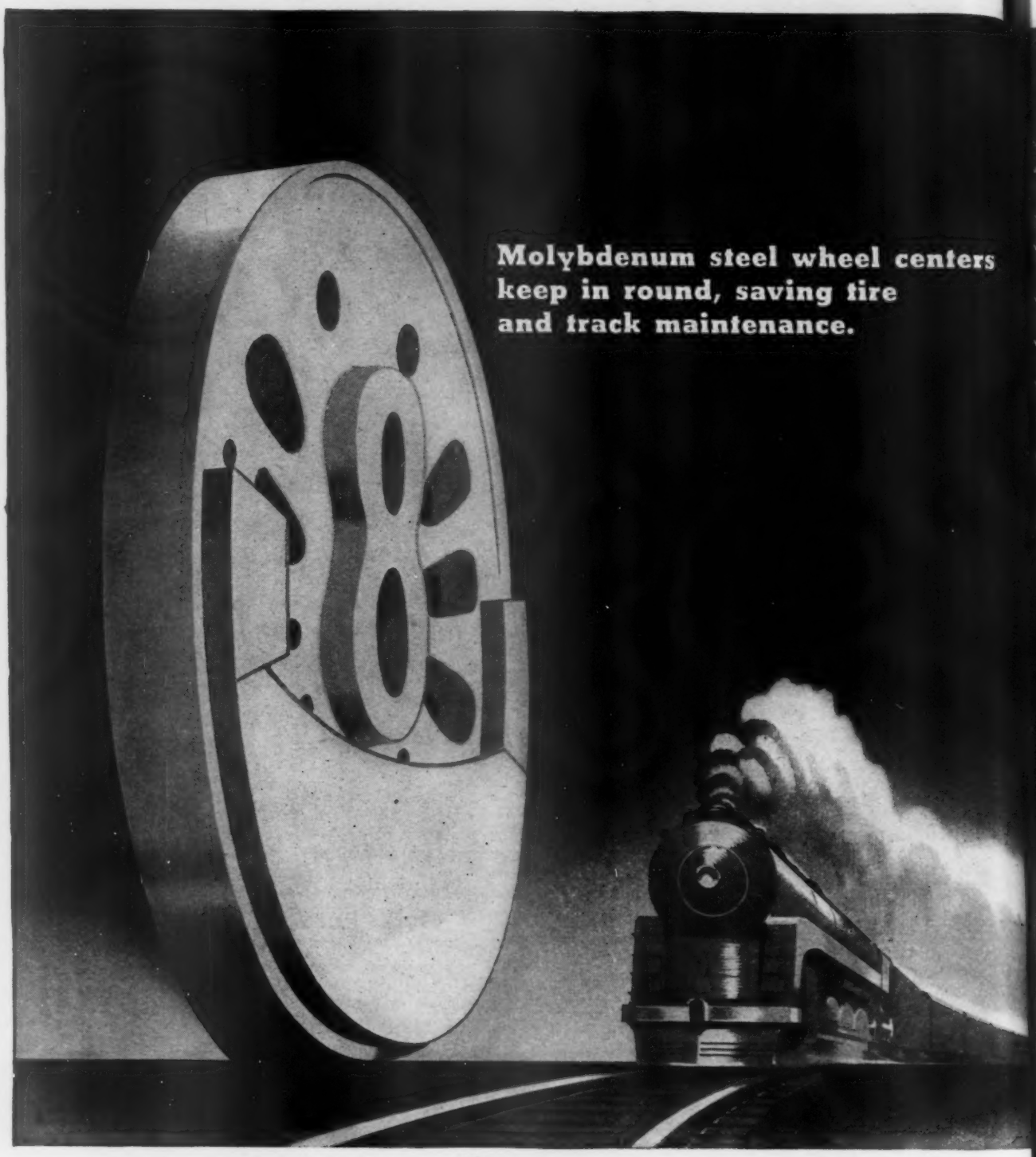
B. F. STURTEVANT COMPANY
Division of Westinghouse Electric
Branch Offices in Principal Cities
HYDE PARK BOSTON 36, MASS.

STURTEVANT GIVES YOU ALL 4 RAILROADING ADVANTAGES

1. More uniform temperature and humidity conditions in the car.
2. Equipment designed for easy maintenance.
3. Equipment designed for minimum space and weight.
4. Equipment that requires a minimum power load.

Sturtevant
Puts Air to Work

STURTEVANT "Railvane" Units or Systems are used by 40 railroads and are covered by more than 80 issued patents and patents pending



CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

ARMY E NAVY

MOLYBDIC OXIDE, BRIQUETTED OR CANNED
FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company

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MOLY

SCULLIN SKILL
IN STEEL
=DEPENDABLE
LOCOMOTIVE AND
FREIGHT CAR
CASTINGS

We have specialized in fine railroad castings of every kind for almost 50 years. Whatever your needs, we have the experience and facilities to fill them promptly.

ARMY NAVY

SCULLIN STEEL CO
SAINT LOUIS 10, MISSOURI
STEEL CASTING MANUFACTURERS SINCE 1899

NEW YORK • CHICAGO • PHILADELPHIA • CLEVELAND • ST. PAUL • BALTIMORE • RICHMOND, VA.

A TRIBUTE TO THE RAILROAD INDUSTRY

More ton-miles of freight hauled and more passengers carried than was ever dreamed possible . . . an enviable record of which the whole nation is proud.

Of course equipment has taken an awful beating but like the good fighter the Railroads' "head is bloody but unbowed".

New building and rebuilding is now the order of the day.

In spite of wartime conditions we have been able to conduct research and development of new Power Sources for:—

TRAIN COMMUNICATIONS
EITHER A. C. or D. C.

FLUORESCENT LIGHTING

CABOOSES

THE SAFETY CAR HEATING AND LIGHTING COMPANY, Inc.
NEW YORK • CHICAGO • PHILADELPHIA • ST. LOUIS • SAN FRANCISCO • BOSTON • MONTREAL

There's no danger of corrosion in this tank car made with Alcoa Aluminum by General American Transportation Corporation for use in carrying acetic acid for the Celanese Corporation.

For tank cars made of Alcoa Aluminum not only resist the attack of many chemicals but they do not form rust to destroy the tanks or contaminate the contents. And they do not require expensive linings.

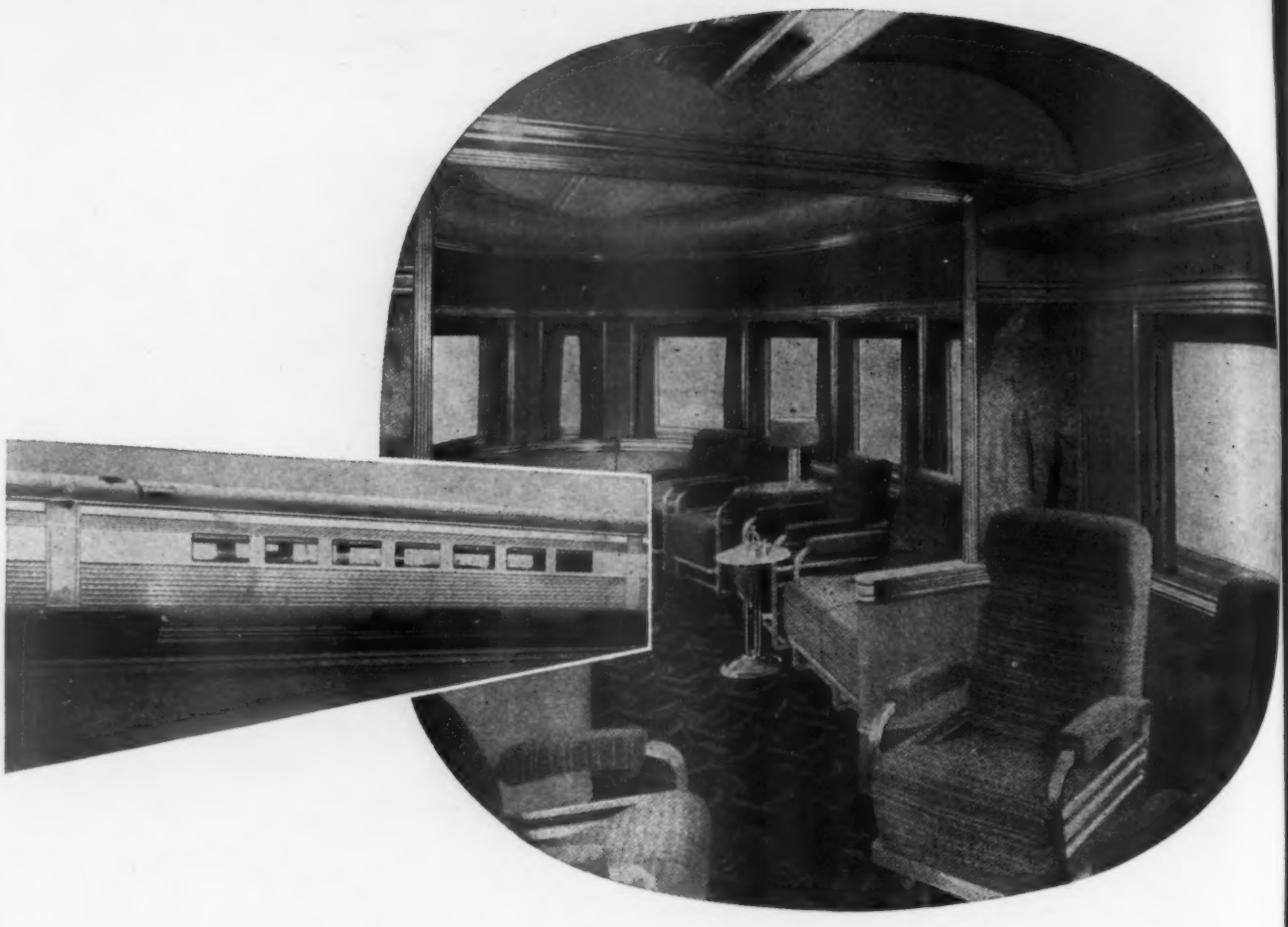
Longitudinal plates and ends of the car shown above were joined by carbon arc welding and the dome was attached by metallic arc welding.

General American Transportation Corporation has built more than 150 tank cars with Alcoa Aluminum. Many of them have been riding the rails for more than 15 years. These cars are used for carrying hydrogen peroxide, acetic acid, nitric acid, formaldehyde and other strong chemicals.

For more information on the way aluminum tank cars give long, dependable service and low maintenance costs in transporting chemicals, write Railway Division, ALUMINUM COMPANY OF AMERICA, 1929 Gulf Building, Pittsburgh 19, Pa.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM



This is Important when you buy

COLD-ROLLED STAINLESS SHEETS

All stainless steel cold-rolled sheets for car sheathing and interior decoration have much in common. They are rustless and they possess high strength. But frequently there is one important difference—the *finish*.

DENSE, UNIFORM SURFACE

Armco's methods of cold rolling stainless steel sheets assure a dense, uniform surface that makes fabrication easier and insures highly attractive cars and parts of all kinds.

ADVANTAGES IN FABRICATING

This dense surface has many advantages in fabricating operations. Even when unpolished it has a beautiful, uniformly smooth finish. When a highly lustrous and reflective surface is wanted for interior decorative trim, the fine-grain of ARMCO 2B finish is especially advantageous in polishing work. Costs are lower because fewer grinding operations are needed.

Armco's rolling practices also assure stainless sheets that are freer from coarsening or "orange peeling" when deep drawn or formed severely.

Get all the facts about this fine-grained rustless steel the next time you plan to use stainless for car sheathing or decorative trim. Better still, let us show you samples of 2B finish on ARMCO Stainless Steel sheets now. Write our nearest district office, or direct to The American Rolling Mill Company, 2891 Curtis Street, Middletown, Ohio.

Export: The Armco International Corporation

The American Rolling Mill Company

STAINLESS ARMCO STEEL

SPECIAL-PURPOSE SHEET STEELS

WHAT IS THE COST?

With reconversion and new construction under way, how important are cost factors? What is the cost of wear and tear and damage due to vibration? By controlling destructive vibration, patented Monroe Direct-Double-Action *Hydraulic* Shock Absorbers minimize costs because they protect lading . . . prolong equipment life and reduce roadbed wear . . . A letter, wire or phone call to our nearest Railway Supply Division will bring you prompt attention.

Railway Supply Division

RAILWAY SUPPLY DIVISION OFFICES:

Monroe, Michigan
1400 East First St.
Tel.: Monroe 2100

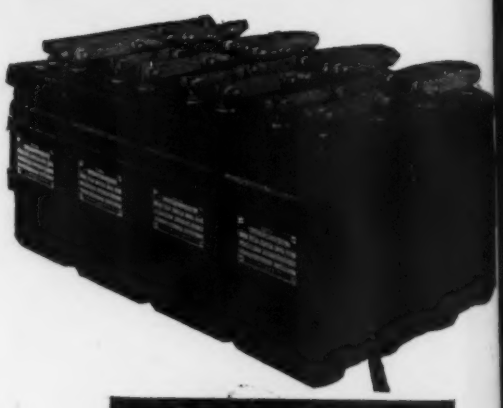
Washington, D. C.
530 Investment Bldg.
Tel.: Republic 1363

Chicago, Ill.
3001 Willoughby Tower
Tel.: Andover 3266

MONROE

ARMY E NAVY

The "high ball" has been given. Those luxurious passenger cars, long on the blue prints, soon will be coming fast off the production lines. With added electrical innovations, Exide Batteries will be assigned new duties . . . and Exide is ready with the finest batteries ever to bear the Exide name. On many of the new cars and locomotives, powerful, rugged Exides will supply current for lighting and air-conditioning, cranking Diesel engines, powering train telephone systems, and performing a multiple of other tasks. And whatever the job, Exides will perform with dependability, long-life and ease of maintenance.



Exide
IRONCLAD
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

QUALITY

MINER

FRICTION DRAFT GEARS

POSITIVE IN ACTION

STURDY

ABSOLUTELY RELIABLE

W. H. MINER, INC. CHICAGO

UP and DOWN
for a million miles
Many Houdaille* railroad hydraulic instruments have cushioned and stabilized the operation of high-speed streamlined trains for more than a million miles.
The lessons learned from more than ten years of "on-the-rail" experience have resulted today in new and improved Houdailles for vertical and lateral control.
HOUDE ENGINEERING DIVISION OF
HOUDAILLE-HERSHEY CORPORATION
MAKERS OF HYDRAULIC CONTROLS
BUFFALO 11, NEW YORK
*Pronounced—Hoo-dye

Specify FOR NEW EQUIPMENT AND MAINTENANCE

Symington COMPOSITE ARTICULATED JOURNAL BOX LIDS

The NEW, IMPROVED LID . . .

★ Light weight—yet sturdy ★ Full Articulation

★ Tight Joint ★ Center Pressure

★ Simple, Easy to Apply and Remove

For full details send for Bulletin describing the B-265 Lid.

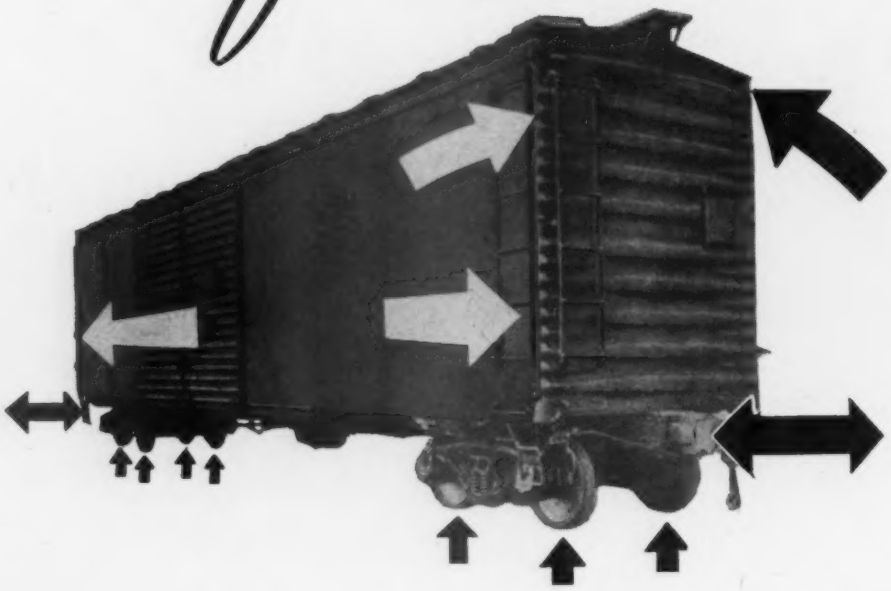
THE SYMINGTON-GOULD CORPORATION

Works: ROCHESTER & DEPEW, NEW YORK

New York • Chicago • St. Louis • Baltimore • Boston • San Francisco • *In Canada:* ADANAC SUPPLIES, LTD., Montreal, Que.

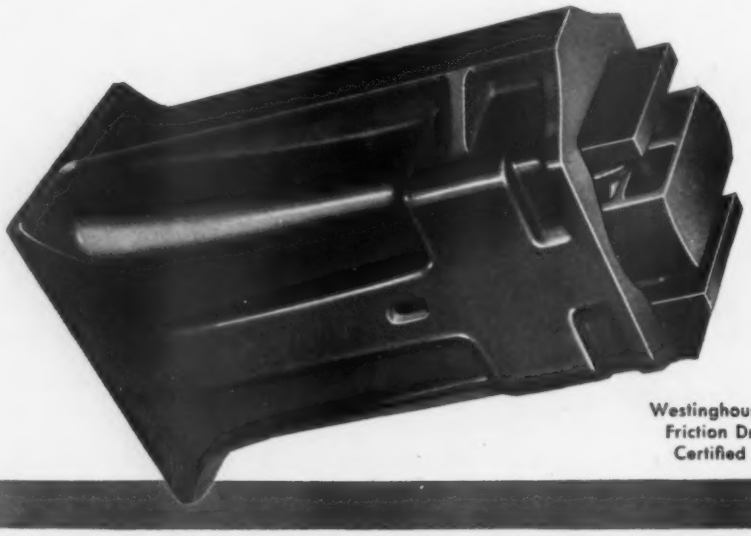
Absorbing the shocks —

— from Every Direction



Cardwell and Westinghouse Friction Draft Gears and Bolster Springs absorb and reduce shocks from *every* direction—buffing, starting, roadbed shocks and side sway — increasing the safety of car movements and preventing damage to cars and ladings.

Over 98% of the cars in freight carrying service are A. A. R. construction, and over 96% have Friction Draft Gears.



Westinghouse NY-11-F Friction Draft Gear Certified A. A. R.

Cardwell Friction Bolster Spring Type A

Cardwell Westinghouse Co., Chicago
Canadian Cardwell Co., Ltd., Montreal

our 50TH ANNIVERSARY

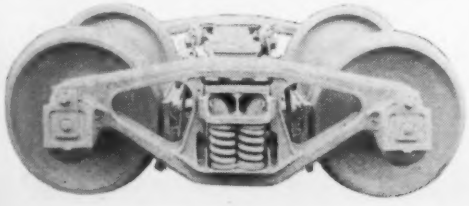
OF SERVICE TO AMERICA'S RAILROADS

"Quality Products" has been our theme ever since we had the privilege of providing the railroads with the first Standard Car Truck Company Lateral Motion Device back in 1895. We plan to continue following the same slogan in the years ahead and one item in this plan is the

BARBER STABILIZED TRUCK

of which over 100,000 car sets have now been supplied to 56 different railroads and private car lines.

For outstanding service, it is the truck you should specify!



STANDARD

CAR TRUCK COMPANY

332 S. MICHIGAN AVENUE, CHICAGO 4, ILL.

Stop Coil Springs from Jitterbugging!

★ This is what Oscillation Curves prove about the movement of your coil spring groups in operation.

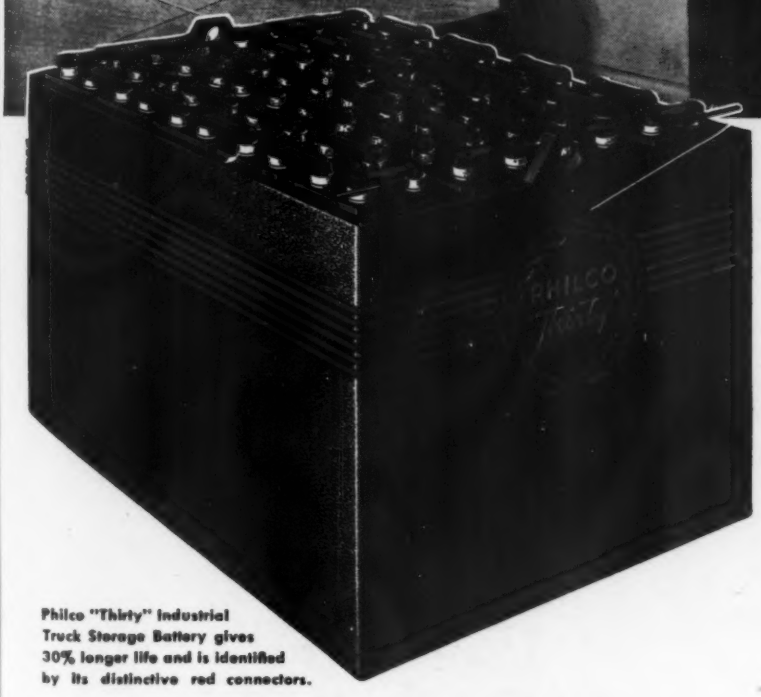
A. A. R. STANDARD SPRING GROUP WITHOUT HOLLAND SNUBBERS

HOLLAND SNUBBER SPRING AND 3 A. A. R. SPRINGS

Style A-6-A Holland *Volute* Snubber Springs

HOLLAND COMPANY

332 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS



Philco "Thirty" Industrial Truck Storage Battery gives 30% longer life and is identified by its distinctive red connectors.

FOR 50 YEARS A LEADER IN INDUSTRIAL STORAGE BATTERY DEVELOPMENT

Tune in The Radio Hall of Fame, with Paul Whiteman and His Orchestra, Sundays, 6 P. M., EST; The Breakfast Club with Don McNeill, 9:45 A. M., EST, Monday through Friday—ABC (Blue) Network (Coast to Coast).

MODERN ELECTRIC INDUSTRIAL TRUCKS POWERED BY COST-SAVING PHILCO "THIRTY" STORAGE BATTERIES

Now you can get the kind of industrial trucks war experience proved the safest, most flexible and maintenance-free — ELECTRIC TRUCKS! And you can power your trucks with the greatest materials handling development since the fork-lift truck, itself—PHILCO "THIRTY", the Storage Battery with 30% longer life! Plan now for the big demands peace-time production will place on your materials handling equipment. Philco "Thirty" will give your trucks top capacity, *plus* savings in maintenance, depreciation and replacements. Write today for new catalogs giving specifications.

PHILCO CORPORATION · STORAGE BATTERY DIVISION · TRENTON 7, NEW JERSEY

PHILCO *Famous for Quality the World Over*

STOP ROLLING TO "KEEP 'EM ROLLING!"

with the IMPROVED

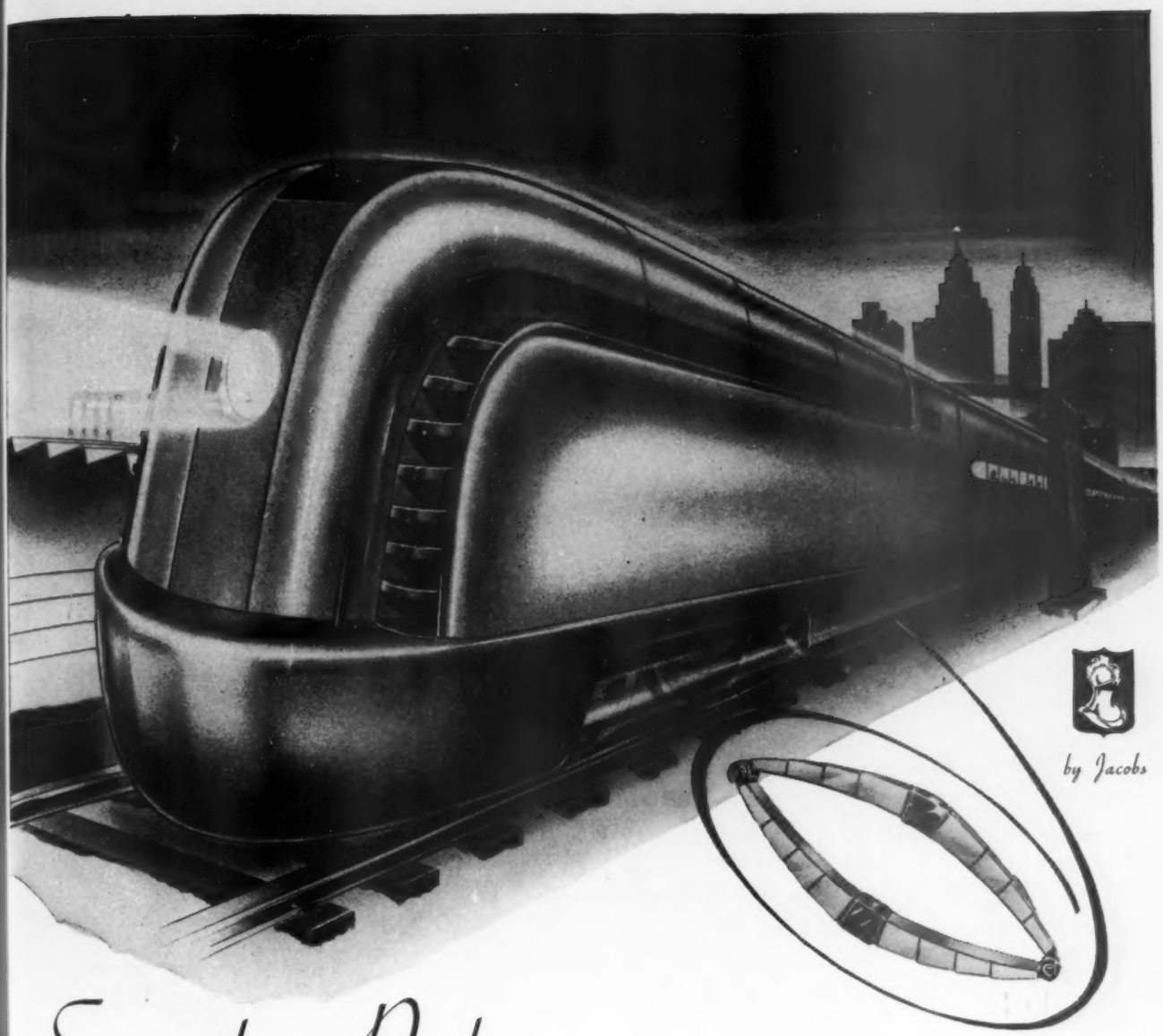
HOLD-RITE
PACKING RETAINER

1. *Reduces Hot Boxes.* Prevents rolling of packing. Holds down loose ends. Reduces waste grabs.
2. Prevents loosening up or displacement of packing under the shocks and jolts of hump yard or high-speed operation.
3. Has extended fingers which hold packing down, *the full length of the journal.*
4. Confines the packing and prevents it from working toward the front of the box, thus assuring packing contact with the journal clear back to the fillet—for positive, better lubrication.
5. Time saved servicing. Necessity for using packing iron practically eliminated; allows more time for repacking or brass changes.
6. Used with or without a front plug, which can be renewed without removing the Retainer.
7. Does not interfere with oiling or inspection of the bearing.
8. No changes required in standard journal box assembly.
9. Low initial cost—pays for itself many times over.

1½ Million
HOLD-RITE
PACKING RETAINERS
are in service on
over 70 railroads

SPRING PACKING CORPORATION

310 S. Michigan Ave., Chicago 4, Illinois



Smoother Performance

Lower Maintenance Costs . . .

While conducting research for improvement of riding quality of railway cars, engineers introduced the application of automobile type steel spring-covers for protection of the leaf springs used on most of the existing railway passenger car and locomotive trucks.

Road tests proved that elliptical leaf springs, when equipped with Ajax Steel Spring-Covers by Jacobs, provided consistently better riding performance and longer spring life.

The Spring-Covers keep dirt and water out and retain the lubricant which protects the springs from wear and stress.

Ajax Steel Spring-Covers, as well as other accessories for railway passenger trucks, designed to radically improve passenger comfort, are marketed as a unit by E. A. LUNDY, INC., 420 Lexington Avenue, New York, New York.

F. L. JACOBS CO.

MAIN PLANT
1043 SPRUCE ST., DETROIT 1, MICHIGAN

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DALLAS PLANT, Detroit, Michigan
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CONTINENTAL DIE CASTING CORP., Detroit, Michigan
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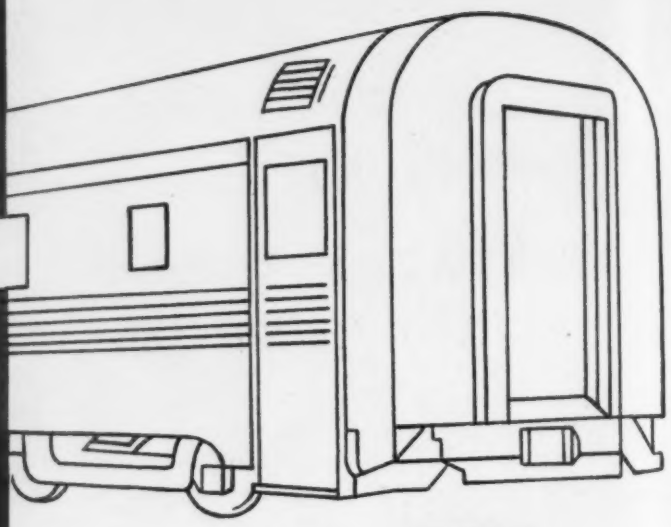


Get Modern

Engineered Lighting

for

Your New Cars

See Electric Service

DESIGNERS, ILLUMINATION ENGINEERS
AND MANUFACTURERS

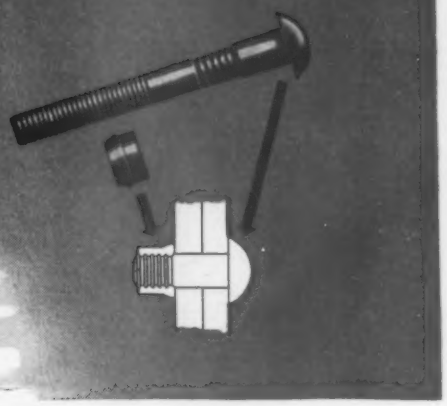
ELECTRIC SERVICE MANUFACTURING CO.

Former Name—Electric Service Supplies Co.

17th & CAMBRIA STREETS • PHILADELPHIA 32 • PA. • Branches in Principal Cities

Announcing the Huck LOCKBOLT *...an*

ENTIRELY DIFFERENT Type of Fastener



The unique Huck Lockbolt combines the advantages of both bolts and rivets in one superior fastening. First it draws the work tightly together in the equivalent of a bolting-up operation as described below; then it is rigidly and permanently locked in place like a rivet. Note these features:

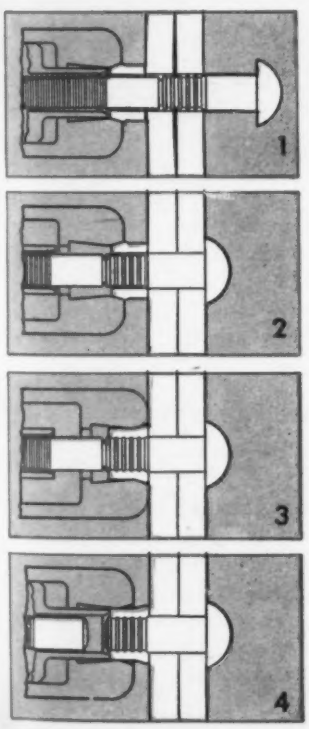
BETTER THAN A BOLT

- More quickly and easily installed.
- Fastens **permanently;** can't loosen under any conditions of vibration or fatigue loading.
- No lock washers, cotter pins or special nuts required.
- Fills the hole completely, yet allows liberal hole size tolerance.
- Uniform tightening assured.

BETTER THAN A RIVET

- Pulls work tightly together before locking.
- Stronger. High-strength alloy steel Huck Lockbolts have a much higher shear strength than conventional steel rivets. Lockbolts of aluminum alloy provide the strength of 24ST rivets without iceboxing. Tensile strength is comparable to that of bolts of the same material.

COMPLETELY NEW OPERATING PRINCIPLE



The Huck Lockbolt consists of two precision-made parts—(1) the pin, which has a head of any desired type, locking grooves, a breakneck groove, and pull grooves which fit the jaws of the driving gun; and (2) the locking collar. The sectional views at left show the driving operation step by step.

1 After the pin is inserted, the collar is slipped on and the gun applied.

2 As the gun pulls the pin, the reaction is taken by the collar against the swaging anvil of the gun, thus drawing the work together as in a bolting-up operation.

3 The pull on the pin is then increased until the anvil is forced over the collar, squeezing the collar into the locking grooves of the pin to form a rigid, permanent lock.

4 The pin is then automatically broken off at the breakneck groove; and finally, ejector member of gun advances to push the anvil off the collar. (Drawing 4 shows this push-off step more than half completed.)

Two types of guns are available: The small hand gun, ideal for maintenance jobs, with which 6 to 10 Lockbolts can be driven per minute; and the faster, light-weight pneumatic gun recommended for production work.

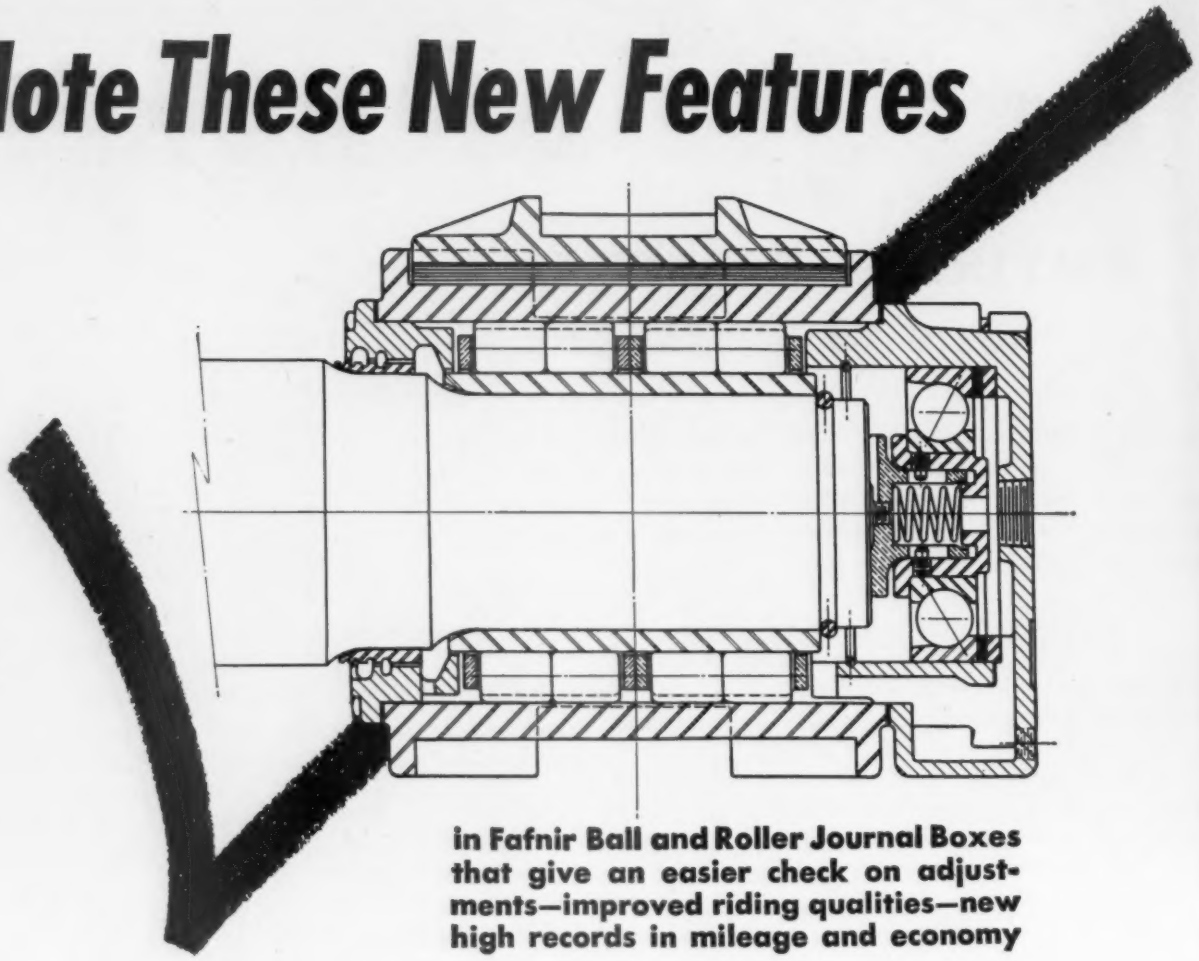
MATERIALS AND SIZES

Huck Lockbolts can be furnished for both hole-filling and non-hole-filling applications, with heads of any type desired, and with pins of 24ST aluminum alloy, carbon steel, or high-strength alloy steel. Lockbolts are now available in 3/16" diameter with grip lengths ranging from 1/32" to 21/32". Lockbolts of 1/4" and 5/16" diameter will soon be available.

Consider how this radically DIFFERENT fastener can simplify YOUR assembly problems. Further information on request.

2480 BELLEVUE AVENUE — *Huck* **MANUFACTURING CO.** — **DETROIT 7, MICHIGAN**

Note These New Features



in Fafnir Ball and Roller Journal Boxes that give an easier check on adjustments—improved riding qualities—new high records in mileage and economy

✓ Keeping in mind the 2,000,000 mile service records and the low cost maintenance figures already set up by Fafnir Ball and Roller Journal Bearings—check up on the service you can expect from these additional features incorporated in the new model Fafnirs!

✓ Spring loaded thrust assembly is in constant contact with the end of the axle thereby eliminating thrust bushing wear and putting pure thrust load on anti-friction bearing.

✓ No increase in lateral clearance due to bushing wear with decrease in operating temperatures.

✓ Conveniently located pipe plug can be removed to simplify checking of lateral clearance, eliminating the necessity of removing entire cover.

✓ Same lateral clearance as maintained in other types of Fafnir Journal Boxes to assure easier riding qualities and to reduce shock impact.

✓ Fafnirs are famous for easy starts and fast hauls—positive lubrication at all speeds—effective sealing out of dirt and water—cutting maintenance costs to the bone—adaptable to Standard AAR pedestal openings as well as most other types of wide pedestal openings—inner rings need not be removed at wheel turning periods, to apply bearings, simply slide on journal. Write for details. The Fafnir Bearing Company, New Britain, Connecticut.

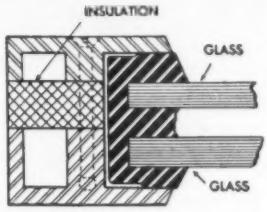
★ 2205

FAFNIR BALL & ROLLER JOURNAL BEARINGS

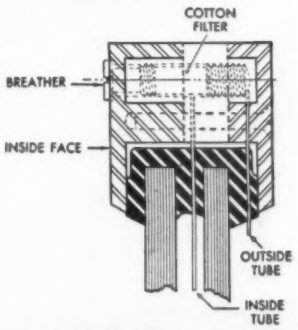
REDUCE STARTING LOADS UP TO 90% . . . CUT MAINTENANCE COSTS TWO-THIRDS

CONSTRUCTION DETAILS

Both frames of Adlake Sash are insulated from each other. This prevents cold from traveling to inside of unit—prevents frosting.



Note inside and outside "breather" tubes. These permit air between panes to adjust to changes in temperature and altitude—prevent clouding without use of a dehydrant.



Adlake CURTAINS . . . should be included. They never shake, rattle, or jangle. Swivel tip prevents change in length; rubber shoes stop noise and creeping. Ask for details about Adlake Curtains, Curtain Fixtures, Sectional Diaphragms, Vestibule Curtains.

BUY MORE WAR BONDS

. . . . . no maintenance is needed

A hunting scene . . . a snow-covered mountain . . . a city skyline, they're there through the advantages of unclouded, unfrosted windows—Adlake windows. Passengers enjoy the scenery. Railroad men appreciate the elimination of maintenance.

Adlake Double-Glazed Sash Units assure clear, unhampered vision at all times. The Adlake Breather—an exclusive principle—permits the air between the panes to adjust itself quickly. No artificial drying method is used.

Adlake Windows use no dehydrating compound, hence there's none to replace. Except for routine washing or broken pane replacement, Adlake Windows require absolutely no maintenance.

Adlake Double-Glazed Windows are again furnished in aluminum or with Alumilite* finish, if desired. They are designed and produced for new cars or for reconditioning present equipment. They are designed and built to standards that have won them a reputation for superiority throughout years of service. Write for prices and details . . . and specify Adlake.

* Patented Process of Aluminum Company of America.

Adlake TRADE MARK

THE ADAMS & WESTLAKE COMPANY

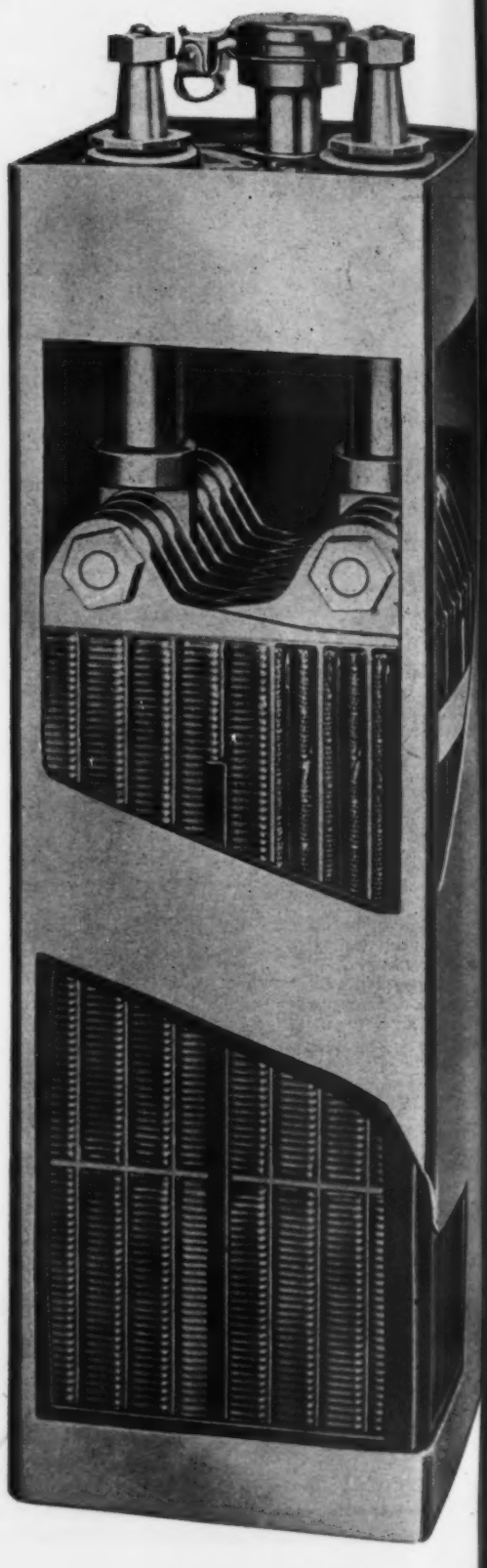
ESTABLISHED IN 1857 — ELKHART, INDIANA — NEW YORK · CHICAGO

ADLAKE RAILWAY CAR EQUIPMENT, FITTINGS and SPECIALTIES • DOUBLE-GLAZED ALUMINUM WINDOWS • WINDOW CURTAINS • VESTIBULE CURTAINS • SECTIONAL DIAPHRAGMS • LUGGAGE RACKS • ASH RECEPTACLES • HARDWARE

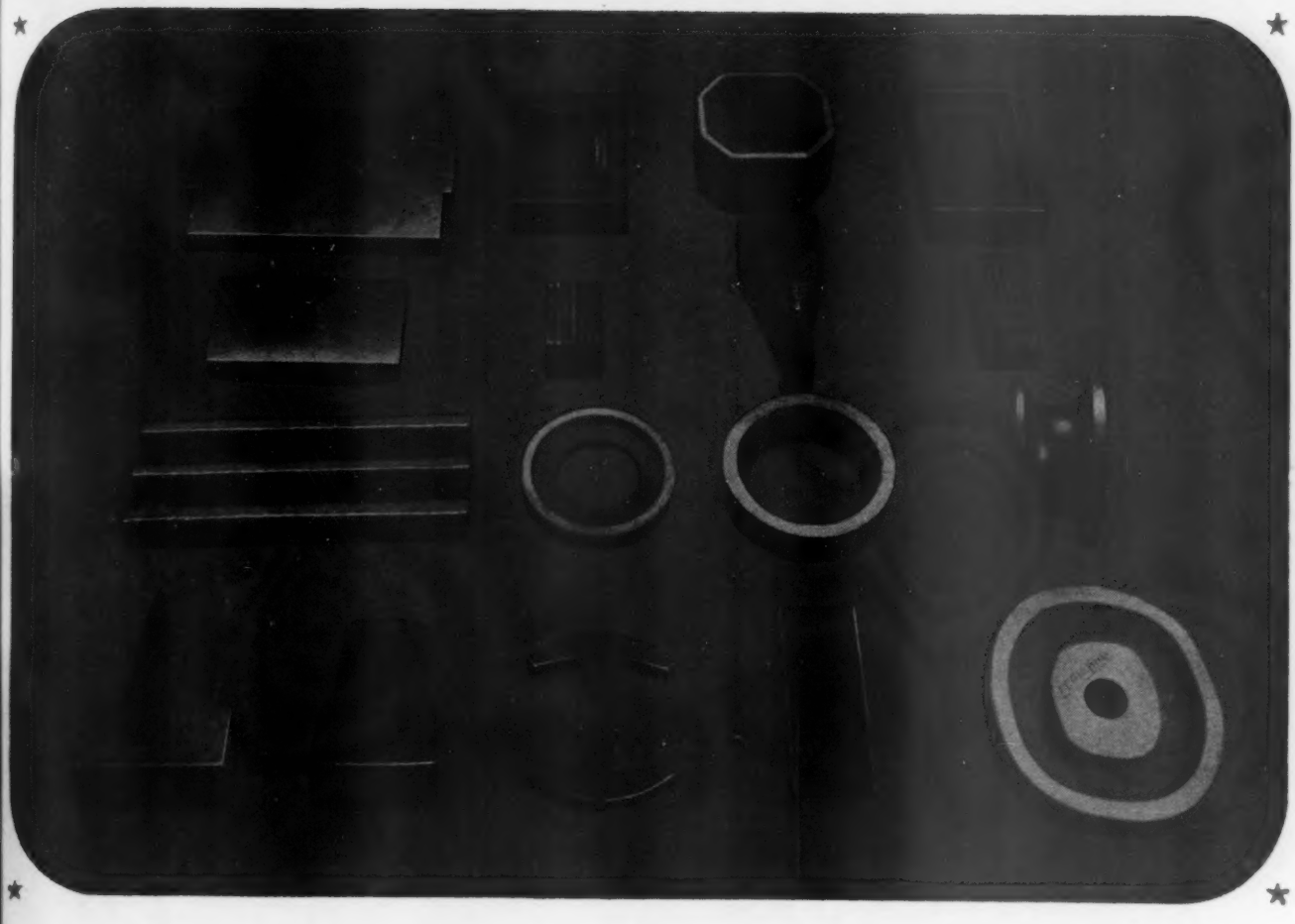
STRONGEST *yet* LIGHTEST

HERE is a cut-a-way view of a single cell of a typical Edison Alkaline Battery for railway passenger car service. Note its construction. It is entirely different from the cell construction employed in other types of storage batteries. The container, cover, pole pieces and other structural parts of the cell are *all* made of STEEL. Even the active materials are permanently locked in perforated STEEL tubes and pockets. These in turn are securely assembled into STEEL grids to form the positive and negative plates. The STEEL cover is welded onto the container. The result is high mechanical strength.

Yet alkaline batteries are also the lightest of all types of batteries available for railway passenger car lighting and air conditioning service. In fact, they are one of the few car accessories in which it is possible to save weight and gain structural strength at the same time. *Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, N. J.*



Edison
ALKALINE BATTERIES



START WITH YOUR JOB *Half Finished*

WRITE FOR THIS BOOKLET

FCC PRODUCTS AND SERVICES

It contains details of FCC Tool Steels *Cast-To-Shape* and of other important Forging and Casting Division specialties that may offer you money-saving production ideas. Get your copy—write for it today.

Address Dept. RME-36

WHEN it's dies you're making—small or large—or various other forming tools or gages or certain fast-wearing parts of machines, FCC Tool Steel *Cast-To-Shape* can really save you money.

Very intricate shapes can now be cast in one piece within an eighth-inch of finished size. This means that you pay for less steel to begin with, and reduce machining time substantially.

Air Hardening, Oil Hardening and special Hot Work Tool Steels of various grades—each a thoroughly dependable performer in its class—are promptly available in this modern, economical form.

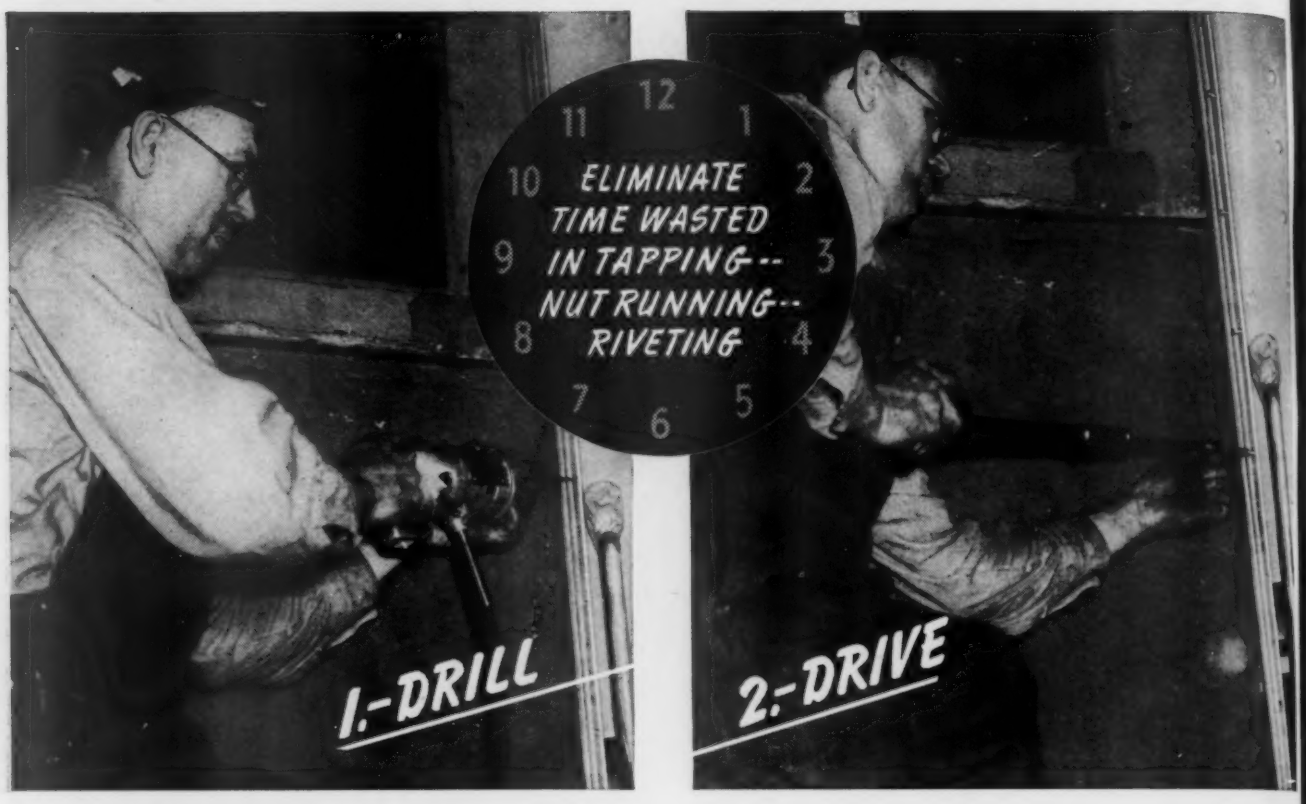
Any Allegheny Ludlum branch office can give you full particulars, or write for data.

ALLEGHENY LUDLUM STEEL CORPORATION

Forging and Casting Division

DETROIT 20, MICHIGAN

RBD 9479-C



Minutes Saved by This Short Cut Mean *Hours* Saved on Car Repairs

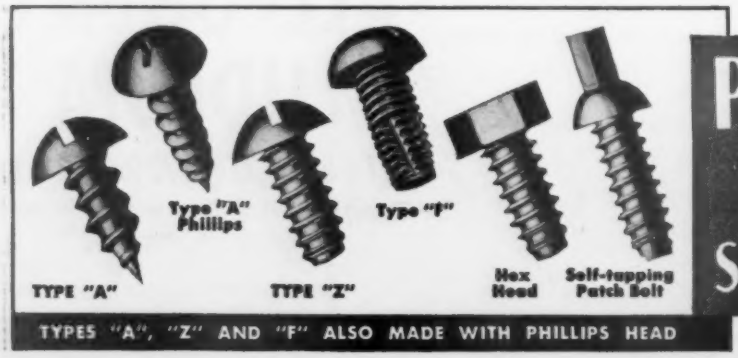
A saving of from 30% to 50% in fastening time and labor – that's what you get when you speed car repairs with Parker-Kalon Self-tapping Screws!

This short-cut fastening method enables you to eliminate the waste of minutes in needless tapping – in fumbling for bolts and nuts – in placing lock washers – in awkward riveting in hard-to-reach places. The change to P-K Screws can be made overnight – no special tools are needed.

P-K Self-tapping Screws simplify the job of making most fastenings to light or heavy steel, cast iron, aluminum, brass or plastics. They have saved countless hours of scarce time for America's largest railroad shops and car builders.

USE THIS HELP – A P-K Assembly Engineer will show you how quickly and easily you can change to this short-cut method. He'll check your fastening jobs and help you choose the best type of P-K Screw for every fastening.

"HOW TO USE" BOOKLET gives you quick facts on all the P-K Self-tapping Screws and other Fastening Devices . . . tells you where and how to use them. Write for Form 480. Parker-Kalon Corp., 298 Varick Street, New York 14, N. Y.



TYPES "A", "Z" AND "F" ALSO MADE WITH PHILLIPS HEAD

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

First Stop
for Repairs in

14 YEARS

Original

PRESSURE-CREOSOTED

SIDING & DECKING
still serving

This gondola, built in 1930, is in the shop for its *first major repairs*. All the decking and siding you see is original material, which has lasted for 14 years under rough usage—and still looks surprisingly good.

The range of life of untreated lumber in this service averages from 4 to 7 years—so that the use of treated material saved from 1 to 3 trips to the shops. The savings are very worth while since the original installed cost was increased only slightly by the preservative treatment.

A lot of railroads that used to wonder if they could afford to use pressure-treated wood are now wondering if they can afford *not* to use it. If you would like to get a line on the general practice in specification for treatment, ask for our 2-page bulletin, "Pressure-treated Lumber for Railroad Cars," which digests this information in a convenient table.

KOPPERS COMPANY, INC.—WOOD PRESERVING DIVISION

PITTSBURGH 19, PA.

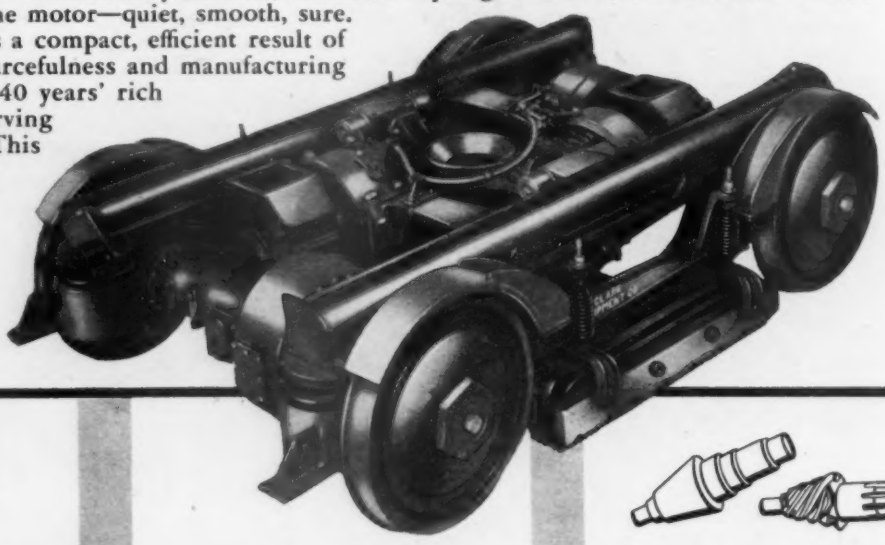
KOPPERS

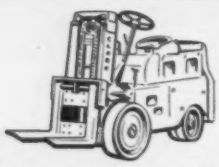
Buy War Bonds—
and Keep Them!

THE INDUSTRY THAT SERVES ALL INDUSTRY

COMFORT undreamed of . . .

THERE'S NO PLEASANTER FORETASTE of the delightful comforts Transportation has in store than a ride on Clark Street Car Trucks. Hypoid gears are silent. Wheels are rubber cushioned—unbelievably smooth, noiseless. Springs are soft, comfortable. Brakes are mounted on the motor—quiet, smooth, sure. . . . Here, truly, is a compact, efficient result of engineering resourcefulness and manufacturing "know how", of 40 years' rich experience in serving Transportation. This is the kind of creative usefulness Industry expects of the Men of Clark.



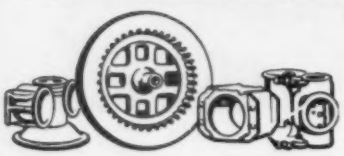


FORK TRUCKS AND INDUSTRIAL TRACTORS

STREET RAILWAY CAR TRUCKS

GEARS AND FORGINGS

One piece, forged, heat treated AXLE HOUSING



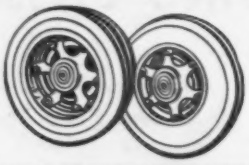
ELECTRIC STEEL CASTINGS

TRANSMISSIONS for Trucks, Busses, Tractors

CELFOR HIGH-SPEED DRILLS AND REAMERS

POWER BOOSTER for 1½-ton Trucks

BLIND RIVETING PROCESS



METAL SPOKE-TYPE WHEELS for Trucks, Busses, Trailers

AXLES—front and rear for Trucks, Busses, Tractors

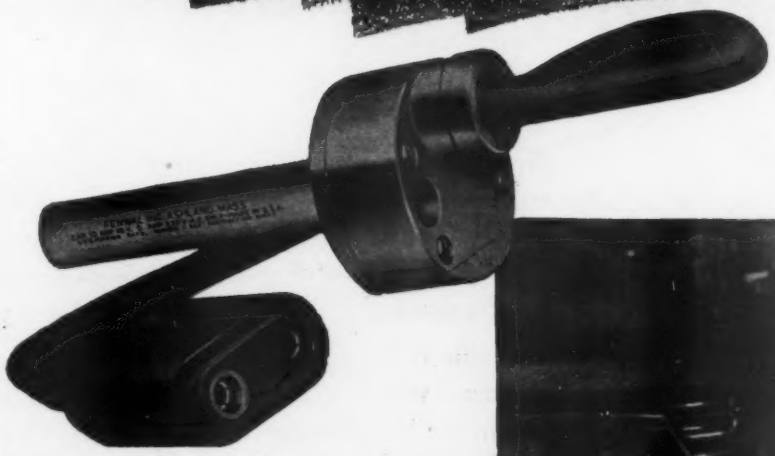
EASY-ROLL TRAILER AXLE

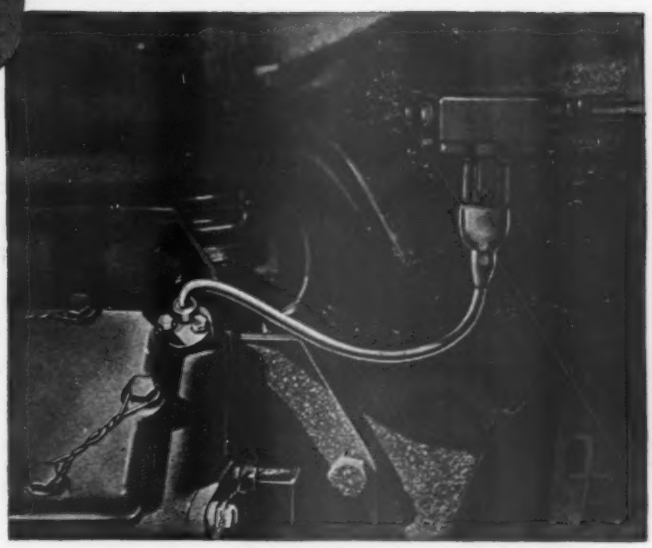
CLARK EQUIPMENT COMPANY

RAILWAY DIVISION - - - BATTLE CREEK, MICHIGAN

NOT JUST A FEW...OR SCORES...OR HUNDREDS...BUT

Thousands of Fenwal THERMOSWITCHES





In Actual Use Today, Protecting Journal Box Bearings of Diesel Locomotives on Leading U. S. Railroads

Eliminating costly delays, breakdowns and valuable time tied up in repairs, Fenwal Journal Box THERMOSWITCH is the simplest, most efficient device ever developed to warn of mounting temperatures in journal boxes. Connected to a panel board in the engine cab, THERMOSWITCH reports by green light that "all's well" . . . by *red* light with timely warning that a hot-box threatens.

This reliable hot-box preventive alarm is now offered to American railroads for protection of passenger car journal boxes. If you will send for latest available data, you'll learn the vital facts of Fenwal protection and Fenwal field engineering service . . . without obligation.

Fenwal, Inc.

THERMOSWITCHES

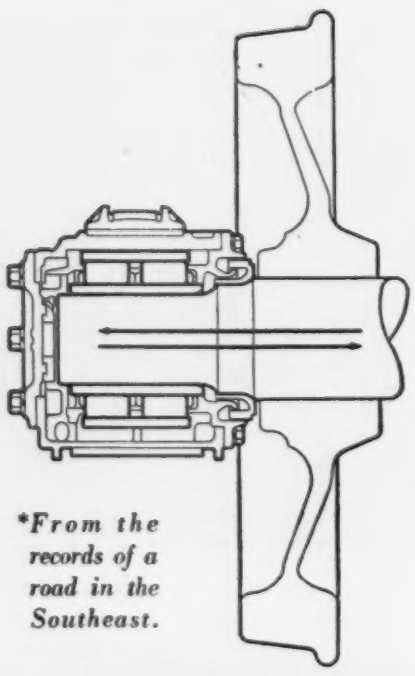
FOR COMPLETE TEMPERATURE CONTROL

63 Pleasant Street, Ashland, Massachusetts

FREE LATERAL=

1,000,000 Miles

Average Life per Set of Wheels— High Speed Service*



**From the records of a road in the Southeast.*

A. A. R. friction type car journals have one virtue which enhances their performance characteristics—free lateral which permits the axles to float laterally—thus lessening wheel flange wear.

That outstanding advantage is also an inherent feature of Hyatt Roller Bearing Journal Boxes—Hyatt equipped boxes also greatly reduce friction and they have operated hundreds of thousands of miles without one penny spent for upkeep or maintenance other than lubrication.

Reduced flange wear saves the costs of more frequent wheel turning—also wheel replacements are less frequent—these are the "extra dividends" you get when you specify Hyatt-equipped Journal Boxes—FREE LATERAL JOURNAL BOXES—for your new cars and changeovers of old cars. Let us tell you more about this. Complete details upon request. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

FREE LATERAL MOVEMENT OF AXLE IS A "HIDDEN GOLD MINE"

HYATT ROLLER BEARING RAILROAD JOURNAL BOXES

They're NEW!
They're STARTLING!
They're PERMANENTLY BRILLIANT!

Safetee Mirrors

"SEALED BRILLIANCE"

PATENT APPLIED FOR

Through Safetee's special laminated construction (patent applied for), these beautiful mirrors are many times as strong and can be several times as THIN as ordinary mirrors. The result is unusual brilliance of image, "feather" weight and high resistance to shocks and cracking. The "silvered" surface—only a fraction of an inch away from the FIRST surface of glass—is SEALED between glass and plastic and is unaffected by salt air or tropical climate. Single or double-faced mirrors are available in the same thickness, beginning at one tenth of an inch (.100").

Here is your TOP VALUE in quality mirrors—for handbag or boudoir, automobiles, public carriers, gift boxes, shaving sets, picture frames, wall mirrors, furniture, etc. Resilvering is eliminated, as SAFETEE MIRRORS are permanently sealed and the image remains sharp and brilliant.

* * *

Full particulars on sizes and prices sent promptly on request.

These remarkable new SAFETEE GLASS MIRRORS introduce—for the first time—four outstanding features and advantages:

1. Greater brilliance than ordinary mirrors.
2. Shatter-resistant like automobile glass.
3. Hermetically sealed reflecting medium, unaffected by moisture, temperature, corrosion and hard use.
4. Available in DOUBLE or Single-faced, sheet or plate, in the SAME THICKNESS.

SAFETEE GLASS COMPANY

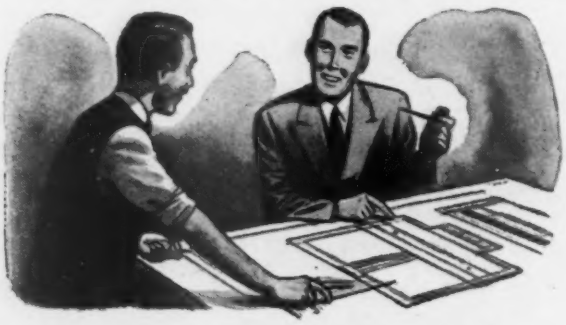
PHILADELPHIA 44, PA.

TUNES OUT TROUBLE

When slotted screws were used by this musical instrument maker, head breakage and driver skids damaged expensive assemblies – required disassembly, costly refinishing, and reassembly. A shift to Phillips Recessed Head Screws ended this trouble, permitted lower assembly costs.

SWING TO SAVINGS

Because the recessed head makes more efficient use of turning power, Phillips Screws can be set up tighter without danger of burring. As a result, fewer Phillips Screws are needed to make the rigid assembly required – a further saving in time and material.



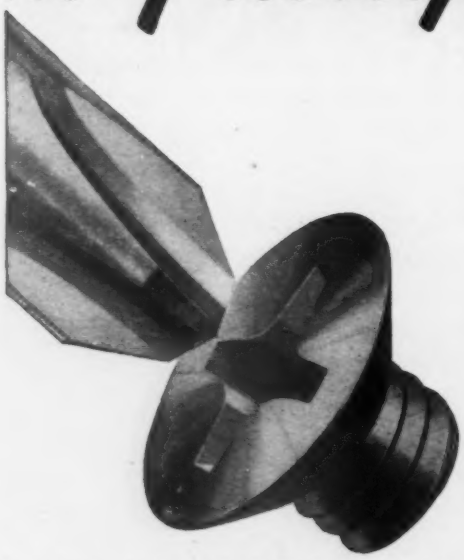
IN TIME WITH TOMORROW

Besides reducing costs and speeding up production, Phillips Screws help designers plan new, simpler methods of achieving strength, rigidity, and improved appearance. Result – a product in step with design trends – and a match for competition in tomorrow's tough markets.

SALES HIT HIGH NOTE

From the sales angle, Phillips Recessed Heads make fastenings a *feature!* No unsightly burrs to cool off prospects! The ornamental pattern of the Phillips Recess blends in harmony with modern design . . . helps start cash registers ringing a sweet sales symphony!

It's Phillips . . . the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

NATIONAL K-4 Friction Draft Gears

were designed to promote riding comfort in passenger train service.

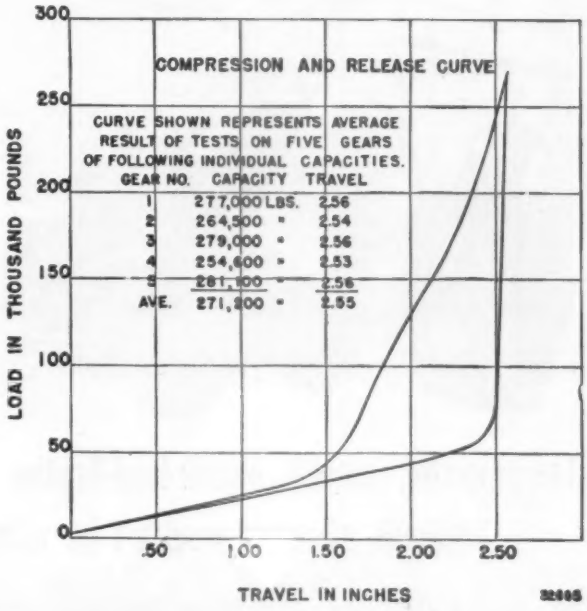
National K-4 Gears start action smoothly, gradually building up resistance sufficient to absorb the heavy blows without shock, and release quickly and smoothly.

The friction system in the K-4 Gear releases first and is always available to cushion a quick succession of blows.

A K-4 Draft Gear applied to the tender will insulate the cars from pulsations from the locomotive.

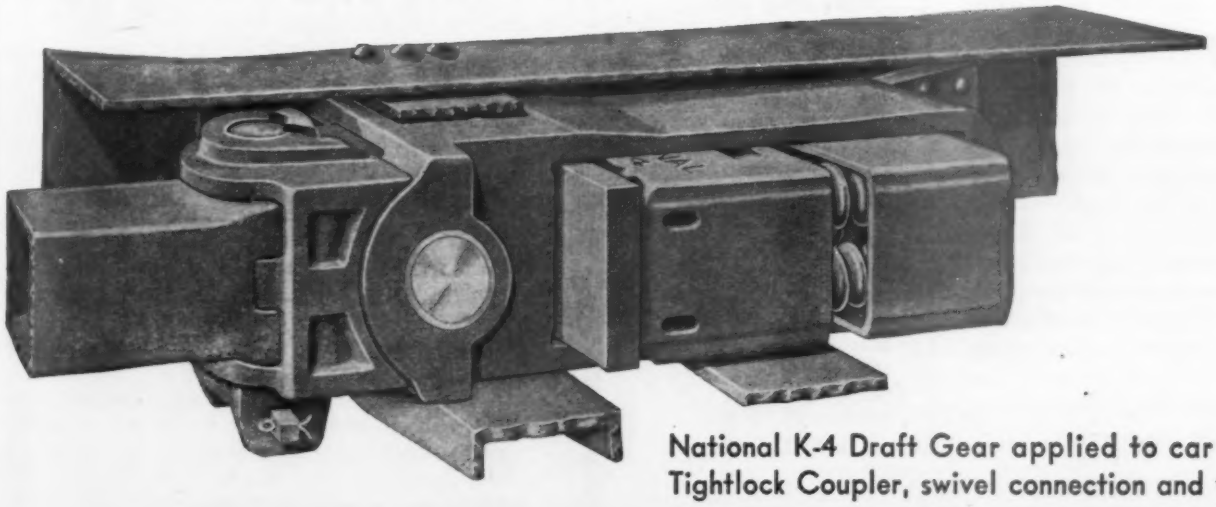
This gear meets the A.A.R. recommendations for passenger equipment type of draft gears.

The chart at the right shows the smooth action of these gears.



M&S Co.

77 Years Service to Transportation



National K-4 Draft Gear applied to car with Tightlock Coupler, swivel connection and yoke.

NATIONAL MALLEABLE AND STEEL CASTINGS CO.

General Offices: CLEVELAND OHIO

Sales Offices: New York, Philadelphia, Chicago, St. Louis, San Francisco.
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.

ROUSTABOUT CRANE

Cuts the cost of 100 load-handling jobs all around your plant....

The powerful, versatile, mobile load-hustler hundreds of users wouldn't be without

● Faster handling *at lower cost* — your needs changes with war's end. You profit from the Roustabout's yard-efficiency as from indoor materials handlers. It's where you want it when you want it, prevents delays, breaks emergencies, gets action everywhere, at low cost, on bulky stuff to 7½ tons. Modernly built for years of overwork — ball-bearing boom turntable and all gears in oil. Full swing boom, smart operation . . . you quickly find Roustabout indispensable. Get the facts — write today!

Roustabout saves you time and money on these and many other jobs

- **Big stuff off and on trucks, freight cars**
- **Moving large machines and parts**
- **Handling bales, boxes, drums**
- **Moving big castings, motors, railroad and marine gear**
- **Loading air transport planes**
- **Handling tanks, pipe, structural steel, rails, timber**
- **Installing heavy valves and fittings**

ARMY E NAVY

THE HUGHES-KEENAN COMPANY
605 NEWMAN STREET • MANSFIELD, OHIO

ROUSTABOUT CRANE

Roustabout Cranes
By Hughes-Keenan
Load-Handling Specialists Since 1904

FAST EASY *Safe* PIPE REAMING

with this extra-long-taper

RIDGID

● You whisk the burr — and only the burr — from any pipe with easy feather-light ratcheted strokes when you use RIDGID Reamer. No thinning of pipe or conduit wall, no splitting or flaring — because of the extra long taper of this remarkable tool. You save pipe — as well as work and time. Buy it complete with ratchet handle — or if you own a RIDGID 00R threader, it fits the handle; buy the reamer unit only. Ask your Supply House.

RIDGID

WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

One of the numerous Stanley Portable Electric Drills in a busy maintenance shop . . . doing "double-duty" as a bench drill, set up in a Stanley 535 Bench Stand.

QUICK CHANGE . . .

from *PORTABLE* to a FAST and HANDY BENCH DRILL!

Outdoors . . . indoors . . . all along the line, Stanley Drills are the handiest tools in any work crew's equipment. In the shop they can be plugged into any convenient electric outlet, and in the yard they can be operated with power from a portable generator that one man can easily carry. Then, too, they're rugged, powerful and dependable . . . they won't fall down on the job. Just give them normal care and maintenance, and they'll stay on the job.

Stanley Electric Drills are made in many sizes . . . capacities from ¼" to 1" in steel. Ask for a catalog or specification sheets. Stanley Electric Tools, Division of The Stanley Works, New Britain, Connecticut.

STANLEY

STANLEY *Electric* TOOLS

XLO

EX-CELL-O *for* PRECISION

PROVEN IN WAR . . .

READY FOR PEACE

EX-CELL-O

HARDENED AND GROUND STEEL PINS AND BUSHINGS

With American railroads facing a new record in peacetime activity, keeping down the "out-of-service" time is increasingly important. Ex-Cell-O Hardened and Ground Steel Pins and Bushings are helping materially to do this for more than 125 railroads. Through long association with these railroads and a careful study of their requirements, Ex-Cell-O has established standard sizes in pins and bushings that include the great majority of sizes commonly used. They are shown in Ex-Cell-O Bulletin 32301. Send for a copy today to Ex-Cell-O, Detroit.

45-120

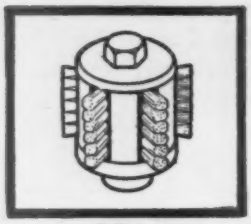
Railroad Division

EX-CELL-O CORPORATION

Detroit 6, Michigan

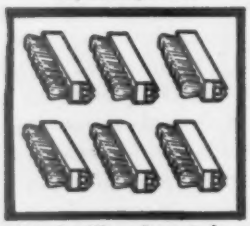
Why WILSON TUBE CLEANER BRUSHES *last* 10 to 20 TIMES LONGER

Ten to twenty times as many tubes can be cleaned with a Wilson Expanding Brush than with ordinary sectional brushes before replacement is necessary. When removing the light, powdery deposits or for final polishing of tubes, the savings in time, labor and money derived from this feature alone make the expanding brush an essential part of every tube cleaning equipment.



Wilson Expanding Brush

Frame or body of expanding brush



Set of refills or faggots for expanding brush

This longer life results from the expanding action of the brush. Because any brush must be smaller than the I.D. of the deposit it removes, the ordinary sectional brush cleans by vibrating against the inner tube wall with a pounding action which hammers down the brush elements.

In the Wilson Expanding Brush, centrifugal force holds the tufts in constant contact with the deposit — eliminating this destructive pounding. Worn tufts in the Wilson Expanding Brush can be replaced easily and quickly — and at low cost.

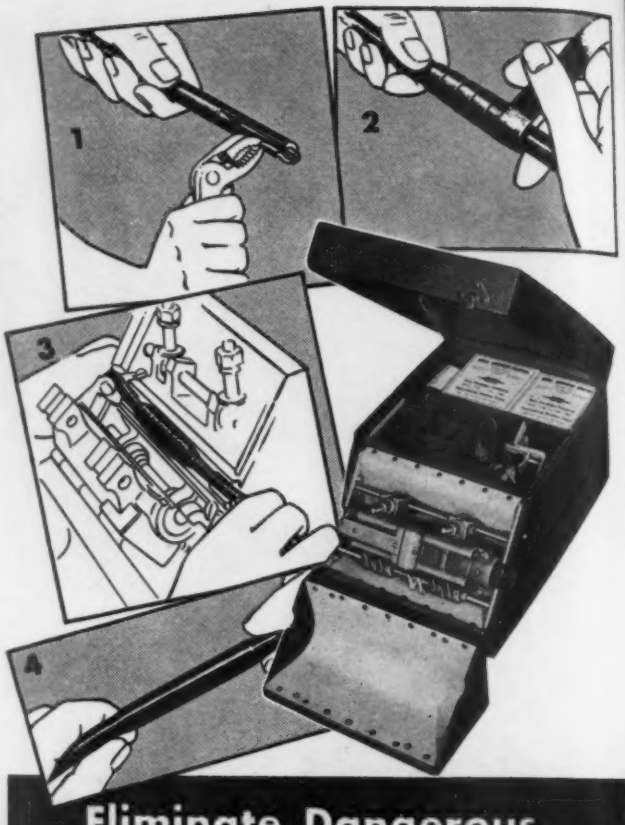
A copy of the Wilson Tube Cleaners Check List will help you select the right Wilson equipment to do your tube cleaning jobs faster and more effectively. Write for your copy today.

MODERN TUBE CLEANERS FOR THE PROBLEMS OF TODAY.

wilson
PIPE AND TUBE CLEANERS

TW-696

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK



Eliminate Dangerous, Make-Shift Cable Repairs with MINES CABLE VULCANIZER KIT!

Make-shift repairs in rubber-covered portable electric cable are a constant cause of trouble, expense, and danger, often causing a portion of the cable to be sent to the scrap pile. Such a dangerous repair can be eliminated through the use of the Mines Portable Cable Vulcanizer Kit.

Thousands of Mines Kits have been in use by all branches of the Armed Forces where trouble-free cable repairs were a necessity and had to be made quickly. A repair made with the Mines Kit is flexible, little more in diameter than the cable itself, and may be wound on a reel.

Safe cable repair made with Mines Kit

Typical ordinary taped splice after a short period of use

The Portable Kit contains all necessary supplies and tools. Molds are available for various cable types. Sizes up to 1⅜ inch diameter may be accommodated in the VDIR-213.

Write for Bulletin RV-104K.

MINES EQUIPMENT COMPANY

4275 Clayton Avenue, St. Louis 10, Missouri

UNIVERSAL BORING MACHINE FEATURES INSURE PRODUCTIVE CAPACITY AND ACCURACY

1. Three Bed Ways — span 44 inches.
2. Table Semi-Box design, heavily ribbed.
3. Motor mounted directly on base.
4. Saddle lead screw nut mounted between guiding ways.
5. Centralized right hand control.
6. Heavy duty type — heaviest 4" spindle machine built.
7. One shot lubrication for head; also for saddle and table assembly.

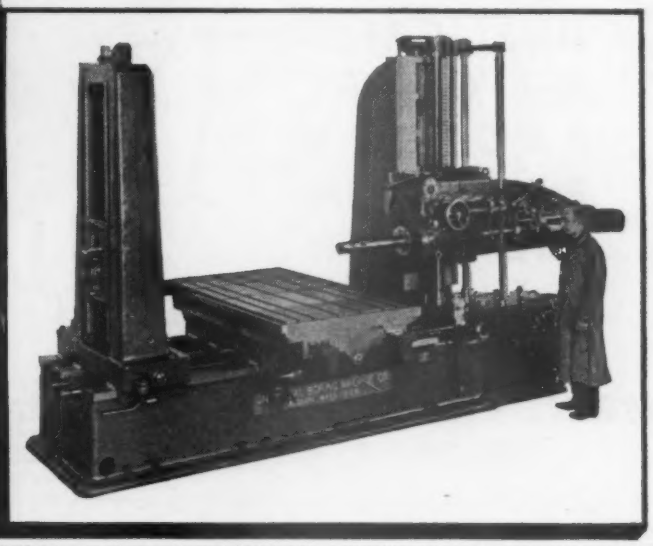
Railway construction and maintenance shops will find the UNIVERSAL BORING MACHINE a welcome addition, because of its versatility in precision machining operations.

This improved UNIVERSAL BORING MACHINE is available in 4" and 5" spindle sizes. Both are readily adaptable to do many boring, milling, turning, facing, recessing, and threading operations.

And UNIVERSAL can also show you how to handle many more precision jobs on a UNIVERSAL HORIZONTAL BORING MACHINE with the Tri-Way bed.

Write today for complete information.

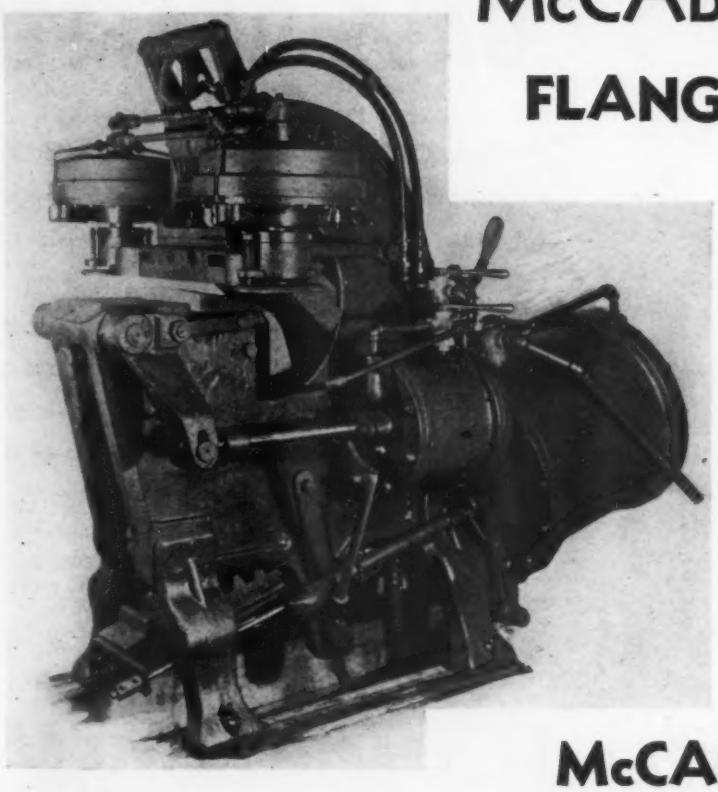
◀ Milling Diesel Engine Frame for Switching Locomotive.



UNIVERSAL

BORING MACHINE COMPANY
HUDSON, MASS., U. S. A.

McCABE PNEUMATIC FLANGING MACHINES



CAPACITY

¾" and 1"

COLD

McCABE MFG. CO.
LAWRENCE, MASS.

HALL

WET TYPE

DIESEL VALVE REFACER

Model 80-A

Special type COLLET holds valve stem securely without brinelling or marking stem.
QUICK-ACTING CHUCK LOCK for quick, easy insertion or removal of valve.
FULL BALL BEARING SPINDLE insures smoother operation.
GRINDING WHEEL MOTOR
WET GRINDING prevents surface burning and stem growth; produces finer finish.
Handles valves to 5" head dia.
MICROMETER WORKHEAD FEED CONTROL Operator knows exact amount of metal being removed.
MASTER MOTOR SWITCH and CUTOUT SWITCH
WORKHEAD MOTOR
RHEOSTAT CONTROL adapts Workhead speed to valve dia.
TRANSVERSE or CROSS-FEED LEVER.
DOVETAIL TYPE WAYS accurately machined. Spring-loaded bronze gibs compensate for wear.

DUPLICATES ORIGINAL FACTORY PRECISION and FINISH

Write the factory or consult your HALL Jobber for complete information on the 80-A Refacer.

THE HALL MANUFACTURING CO.
TOLEDO 7, OHIO

LOCOMOTIVE DRAFTING IS EASIER WITH A

GALE DRAFTER

The Gale Compressed Air Locomotive Drafter is designed to draft locomotives in the engine houses without utilizing steam. Compact and lightweight, the unit is easy to handle and flexible in operation. The Gale Drafter consists of a specially constructed air motor equipped with a suction-type fan, and provision for cooling the housing makes it possible to remove the drafter from the stack immediately upon completion of its task.

The Gale Locomotive Drafter is inexpensive in first cost and requires a minimum of maintenance.

NATIONAL BOILER WASHING SYSTEMS
80 E. JACKSON BLVD. CHICAGO 4, ILL.

Okadee
BLOW OFF VALVES

SPECIALLY BUILT *for Locomotive Service*

These valves by the very nature of their design and construction are duty bound to perform faithfully and positively under the most exacting conditions.

When you install Okadee Valves on your equipment, you are assured of low maintenance and maximum dependability. They are the choice of many railroads and thousands are in service. Their reliability has been proven for over twenty-five years and today they are serving with more confidence than ever before.

The Type FSD Okadee Valve as pictured above is typical for locomotives and is made in 1½" and 2" sizes with cast steel body and cast or forged handles.

Catalog and prices in Okadee's complete line of Locomotive Specialties will be gladly furnished on request.

THE OKADEE COMPANY
332 SOUTH MICHIGAN AVENUE, CHICAGO

Money to burn ?

Boiler scale and sludge burn your operating dollars in three ways:

1. By decreasing boiler efficiency.
2. Through increased maintenance expense.
3. By excessive fuel cost.

Put RC WATER CONDITIONER to work and save this loss.

It will help eliminate existing scale and sludge and prevent future accumulations.

RC WATER CONDITIONER is safe and easy to use—there is nothing to add—requires no pre-boiling, and is economical.

We will gladly arrange for a demonstration without obligation.

Keep your boilers METAL clean.

Write Us RC PRODUCTS *Today*

RIDGEFIELD CHEMICAL PRODUCTS COMPANY
INCORPORATED
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Please send full data.

Name .....

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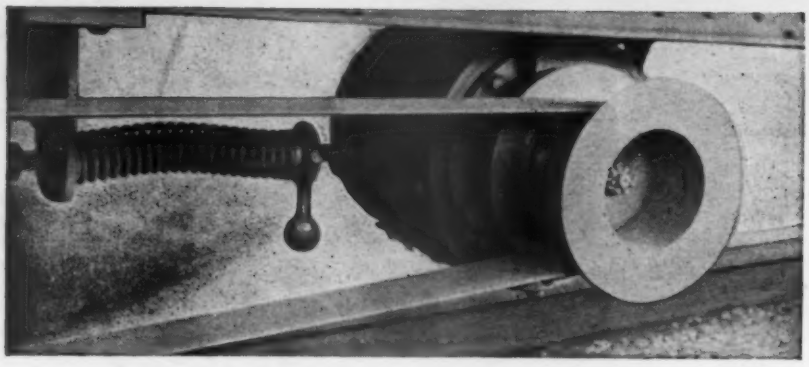
VEELOS *Balata* BELTING



- Minimum Stretch
- High Tensile Strength
- High Coefficient of Friction
- Stronger Fastener Anchorage
- PROVEN Low Car-mile Cost

MANHEIM MFG. & BELTING CO.

NEW YORK OFFICE
50 Church St.

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407 S. Dearborn Street

IDEAL TUBE EXPANDER

THE LEADING ROLLER-TUBE EXPANDER FOR THE PAST 50 YEARS IN AMERICA'S LEADING RAILROAD SHOPS

Ask for Catalog No. 57R

THE GUSTAV WIEDEKE COMPANY

DAYTON — OHIO

3 "OLD TIMERS"

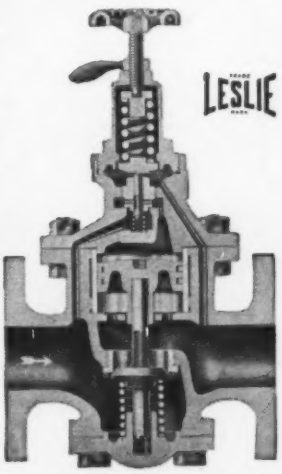
S. Inglis Leslie, President, and R. J. (Bob) McIlwain, oldest employee and foundry consultant, inspect 35-year old veteran LESLIE Reducing Valve.

The above illustration marks three separate yet closely related records of service, each indicative of long-term LESLIE quality and reliability.

For, the recent arrival of a 10 in. LESLIE Class F Reducing Valve back for its first repairs after 35 years of hard service, likewise marked 40 years of service with LESLIE CO. of two men closely identified with long-life records of LESLIE Products.

This Reducing Valve, used for controlling steam to reciprocating engines, needed only minor repairs. Following that, it was again returned to the same service, after receiving (and successfully standing) the same rigid maximum steam pressure and operating tests which it underwent prior to shipment 35 years ago—ample indication of a quality that has kept abreast of the best in materials for regulator manufacturing and performance.

To borrow the words of one user, "These Reducing Valves give unbelievable satisfaction. Their constant reliable performance will please any engineer. They are as reliable as the setting sun."



Class L-3 LESLIE Pressure Reducing Valve, Self-contained, Spring loaded, internal pilot, piston operated.

SEND FOR

your copy of Bulletin 401-A giving latest engineering data on Pressure Reducing Valves for steam and air service.

LESLIE CO.

275 Grant Avenue • Lyndhurst, N. J.

LESLIE factory-trained engineers to help you with your regulation problems are located in these cities:

Baltimore, Md.	Los Angeles, Cal.	Rochester, N. Y.
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ESTABLISHED 1900

LESLIE CO.

PRESSURE REDUCING VALVES · PRESSURE CONTROLLERS
PUMP GOVERNORS · TEMPERATURE REGULATORS
SELF CLEANING STRAINERS · LESLIE-TYFON WHISTLES

Quickly cuts steel up to 16 gauge

SKILSHEAR

ONLY 5½ LBS.

Cuts steel up to 14 gauge without distortion

SKILNIBBLER

ONLY 5 LBS.

BOTH OF THESE TOOLS . . . are compact, light weight (up to 3 lbs. lighter than other tools of similar capacity) . . . amply powered for fast cutting of hot rolled steel up to recommended capacity, softer materials in proportion . . . cool running, comfortable to the hand . . . elimination of customary handle gives operator complete control of tool in all positions. Ask your distributor today for a demonstration.

SKILSAW, INC.

5033-43 Elston Ave., Chicago 30, Ill. • *Factory Branches in All Principal Cities*

PORTABLE ELECTRIC

SKILTOOLS

MADE BY SKILSAW, INC.

FOR 101 METAL CUTTING JOBS

WELLS NO. 8

Versatile

Here, in the Wells No. 8, is one of the most useful and versatile machines you can have in your shop. You will use your Wells for all types of cut-off work around the plant—in the stock and tool rooms and for maintenance.

It efficiently cuts bar stock, angles, square or round tubing—all types of metals. For production work, your Wells can be equipped with the new Wells Wet Cutting System for faster cutting and blade saving. Because it's portable, you can save time and labor by moving the saw to the work.

The gravity-feed and automatic shut-off make it possible for one man to operate two or more Wells saws simultaneously. Why not write today for full information?

Specifications

CAPACITY: Rectangular	**8" x 16"**
(Special Guides)	**5" x 24"**
ROUNDS:	**8" Diameter**
MOTOR:	**½ H.P., A.C. or D.C.**
SPEEDS:	**Selective 60, 90, 130 feet per minute**
WEIGHT:	**Approximately 750 pounds**

Wells SAWS

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1616 POLK STREET, THREE RIVERS, MICHIGAN

STATEMENT of the ownership, management, circulation, etc., requirement by the Acts of Congress of August 24, 1912, and March 3, 1933, of *Railway Mechanical Engineer*, published monthly at Philadelphia, Pa., for October 1, 1945.

State of New York }
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Roy V. Wright, who, having been duly sworn according to law, deposes and says that he is the Editor of the *Railway Mechanical Engineer* and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Corp., 30 Church St., New York, N. Y.

Editor, Roy V. Wright, 30 Church St., New York, N. Y.

Managing Editor, C. B. Peck, 30 Church St., New York, N. Y.

Business Manager, R. E. Thayer, 30 Church St., New York, N. Y.

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4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

ROY V. WRIGHT.

Sworn to and subscribed before me this 24th day of September, 1945.

EDMUND J. PUYDAK.

[SEAL] (My Commission expires March 30, 1947)

BUY
VICTORY BONDS

Coup de Main: The battle royal or main bout, which immediately followed a general softening-up during knighthood forays.

Morganite

CARBON BRUSHES

MORGANITE BRUSH COMPANY, INC., LONG ISLAND CITY 1, N. Y.

1679 Telegraph Avenue
Oakland 12, California
Tel. - GLencourt 5838

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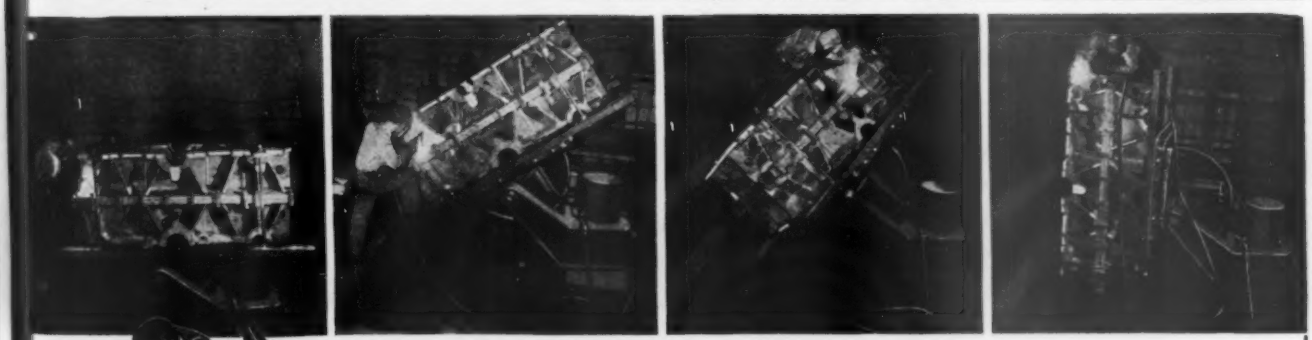
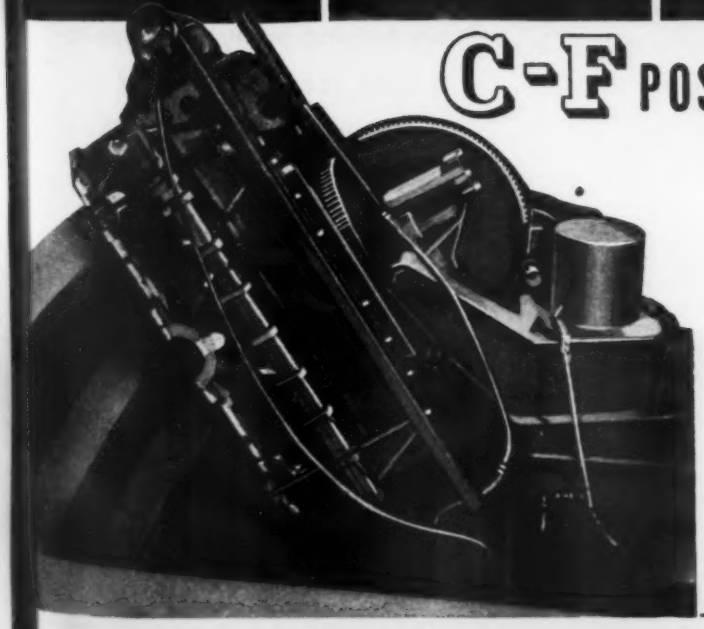
Looks as though new methods sometimes bust an old problem wide open!

We have an arsenal of new grades to try on your commutation problems—old or new. Why not try one?

Use MORGANITE and know you're right!





C-F POSITIONERS cut welding time and cost on heavy gear cases

This special installation of a 14,000 lbs. capacity C-F Positioner allows all the welding on two large units in a downhand position and with a single set-up! Two units are mounted together with the positioner extended over a pit. The long weldments can then swing from horizontal to 135°, and can be rotated 360° with variable speeds from 0 r.p.m. up. The need for a "strongback" is eliminated and ample floor space and headroom under cranes assured.

C-F Positioners and installation technique can cut *your* welding time and cost. Capacities from small hand operated positioners to large units handling 30,000 lbs., are available.

Write for Bulletin WP-22

CULLEN-FRIESTEDT CO.

1324 S. Kilbourn Avenue Chicago 23, Ill.

Photos courtesy of Farrel-Birmingham Co., Inc., Ansonia, Conn.

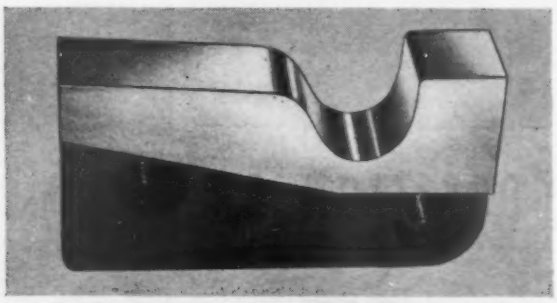
BUCKEYE
6 and 8 wheel *Tender Trucks* Ⓑ

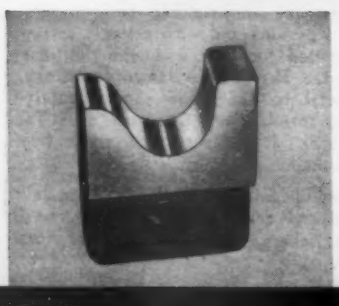
Buckeye Six and Eight Wheel Tender Trucks
in Freight and Passenger Service
have demonstrated
OPERATING ECONOMIES
due to
Reduced Weight . . . Fewer Wearing Parts . . . Positive Equalization

THE BUCKEYE STEEL CASTINGS COMPANY
Manufacturers of Couplers, Truck Frames and Bolsters,
Draft Attachments and Tender Trucks
NEW YORK COLUMBUS, OHIO CHICAGO

GORHAM

TRU-FORM • TOOLS •





GORHAM TRU-FORM TOOLS are helping many railroads to reduce locomotive and car wheel tire turning costs. They retain their original form and contour regardless how much is ground off the face of the tool.

GORHAM TOOL COMPANY
14400 WOODROW WILSON • DETROIT 3, MICHIGAN

because he can get at the work

Ransome Positioners help men to do more and better work by attaining maximum accessibility. Tilting and rotating become easy and your product is always in a convenient position for assembly, drilling, overhauling, repairs and many other shop uses.

Handy bench model positioner shown above on motor repair and assembly. Sub-illustrations show overhauling of gasoline engine and drilling application. Other models up to 40,000 lb. capacity. Write today for your copy of bulletin describing complete line.

R5-19A

Subsidiary of
WORTHINGTON
Pump and Machinery Corporation

Power Plant Equipment • Turbines & Turbo-Generator Sets • Diesel & Gas Engines • Pumps & Compressors • Air Conditioning & Refrigerating Equipment • Construction & Mining Machinery • Power Transmission Equipment • Locomotive Feedwater Heaters • Welding Positioning Equipment • Liquid Meters

Industrial Division
Ransome
MACHINERY COMPANY
Dunellen, New Jersey

SPEER BRUSHES give you . . .

. . . subdue troublesome motors and generators

Having trouble getting at the root of brush troubles on d-c and slip-ring motors and generators—sparking, overheating, burning, energy losses? Maybe the brushes are "misfits."

Switch to SPEER Brushes for *double* assurance of peak performance from any commutating equipment—*double* assurance because every SPEER brush is matched, both mechanically *and* electrically, to the machine it's sold to serve.

Save time. Avoid experiments. SPEER can supply the brushes you need from its all-inclusive line of standard and special carbon, graphite, electro-graphite, and metal-graphite brushes. SPEER has been a recognized specialist in matching brushes to machines for almost 50 years.

So for brushes matched to *your* machines, call on SPEER for experience. Write for Brush Data Forms—a Speer service, no obligation.

CHICAGO • CLEVELAND • DETROIT
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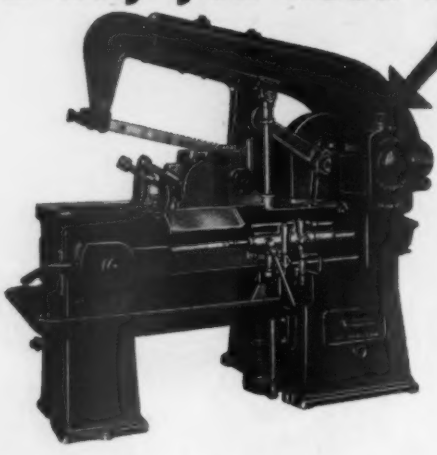
SPEER
CARBON COMPANY
ST. MARY'S, PA.

DUAL FEED...
and why you need it



MODERN METAL WORKING PRACTICE requires proper application of the cutting tool. In RACINE Machines "Dual Feed," hydraulically controlled, provides two distinct cutting actions for materials of varying area and hardness.

RACINE's exclusive "Dual Feed" consists of Positive and Flexible Feed, progressively applied — hydraulically controlled. Round bars, odd shaped pieces, tubing and free cutting stock require a compensating type of feed for maximum cutting efficiency. RACINE's "Flexible Feed" automatically picks up speed as the resistance to the blade decreases. You benefit by increased output.

Under "Positive Feed" the teeth of the blade are forced beneath the surface of the stock. This positive feeding action is essential to efficient, accurate cutting of high speed steel and other hard, tough materials. With "Positive Feed" on your RACINE Machine, all cuts are made in exactly the same time, predetermining production.

A nationwide organization of competent, experienced machine tool dealers sells and services RACINE Machines. Send us an outline of your cutting problems. Our dealers and factory engineers will make up recommendations without cost to you. Free Catalog No. 12 will be included. It briefly describes the various machines in capacities from 6" x 6" to 20" x 20". Write today.

comparison proves

- ★ The Racine Machine line is complete — all capacities from 6" x 6" to 20" x 20".
- ★ Special designs are available for special jobs. Sawing is cheaper than milling.
- ★ All models are simple, easy to operate, rugged and long lived.
- ★ Service and sales facilities available everywhere. Deal with trained and experienced machine tool men.

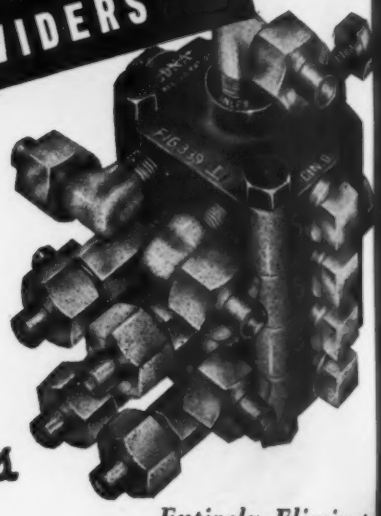
RACINE "VARIABLE VOLUME" PUMPS—
A MODERN SOURCE OF HYDRAULIC FORCE

Oil Hydraulic Power from 50 to 1000 lbs. P.S.I. Variable Volume from zero to 30 G.P.M. Use RACINE Pumps on your new designs and apply them to existing circuits. Let our hydraulic division engineers explain the advantages of hydraulic operation and control for your products. RACINE TOOL AND MACHINE COMPANY, 1740 State St., Racine, Wis., U. S. A.

RACINE

Racine
The Production Saws of Modern Industry

EDNA
"POSITIVE" OIL FEED DIVIDERS



2 to 8 Outlets
Entirely Eliminate Hand Oiling

The EDNA Positive Oil Feed Divider now makes possible far greater efficiency in automatic division and distribution of lubricants to all machinery points. Multi-Feed Dividers eliminate the number of active lubricator feeds required, reduce the quantity of pipe needed for any application. Lubricant flows freely up to 10,000 lbs. pressure per square inch! And in extremely cold weather operates with complete efficiency. Priced from $17.50 to $43.50. For further details and list of railroads now using Edna Dividers, write for Bulletin No. A-101A.

REPAIRS
NONE

CLEANING
NOT GENERALLY REQUIRED

INSPECTION
NONE

MAINTENANCE
NONE

POSITIVE
Dependable operation. Works against steam or atmospheric pressure.

FLEXIBLE
Available in unlimited number of practical combinations to divide and deliver lubricants to any points and in any quantities.

ECONOMICAL
Because of high quality of materials and simple design, requires no maintenance. Initial cost is last cost.

FORCE FEED LUBRICATORS
"POSITIVE" OIL FEED DIVIDERS
AUTOMATIC AUXILIARY LUBRICATORS
HYDROSTATIC LUBRICATORS • OIL CUPS
LIFTING and NON-LIFTING INJECTORS • BOILER CHECKS
VALVES • COCKS: CYLINDER — GAUGE — TANK
REFLEX WATER GAUGES • WATER COLUMNS
"EDNALOY" CASTINGS

THE EDNA BRASS MFG. CO.
Sales Agent of National Lead Company
525 READING ROAD CINCINNATI 2, OHIO

GRIND CARBIDE & CAST ALLOY CUTTING TOOLS AT 5-20 TIMES LOWER GRINDING COST

BUXITE PROCESSED

A NEW HARDENER ADDED TO GRINDING WHEELS
REDUCES WHEEL WEAR
AFFORDS COOLER CUTTING, BETTER FINISH, LONGER WHEEL LIFE
MAKES GRINDING EASIER

BuXite—developed through long research, and brought to completion by the exacting needs of war work, is a method of hardening all types of grinding wheels. The BuXite Process coats the grain of the wheel, and, under the pressure and heat of grinding, this coating changes into a "case" hardening that is comparable to diamond hardness.

With BuXited wheels, sintered carbide and other superhard metals and alloys can be successfully ground under ordinary shop conditions —and with remarkable economy in tool life, due to improved finish, cleaner grinding, and elimination of excess heat. BuXited wheels grind the shank and the carbide at the same time without "loading"—saving extra operations.

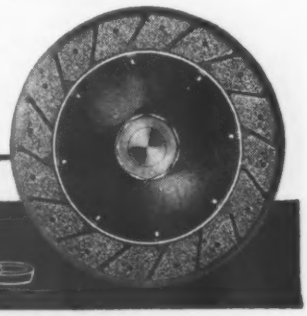
BuXited wheels give equally good results on tool steels, cast iron, brass, all metals—in precision and form grinding and in snagging. In snagging, the increased production speed which is possible requires less dressing, resulting in more work with less effort.

BuXite is now available in all "Bridgeport" wheels. Consult us on your grinding problems. Share in the benefits from this greatest single advance in grinding wheel practice in the last 25 years!

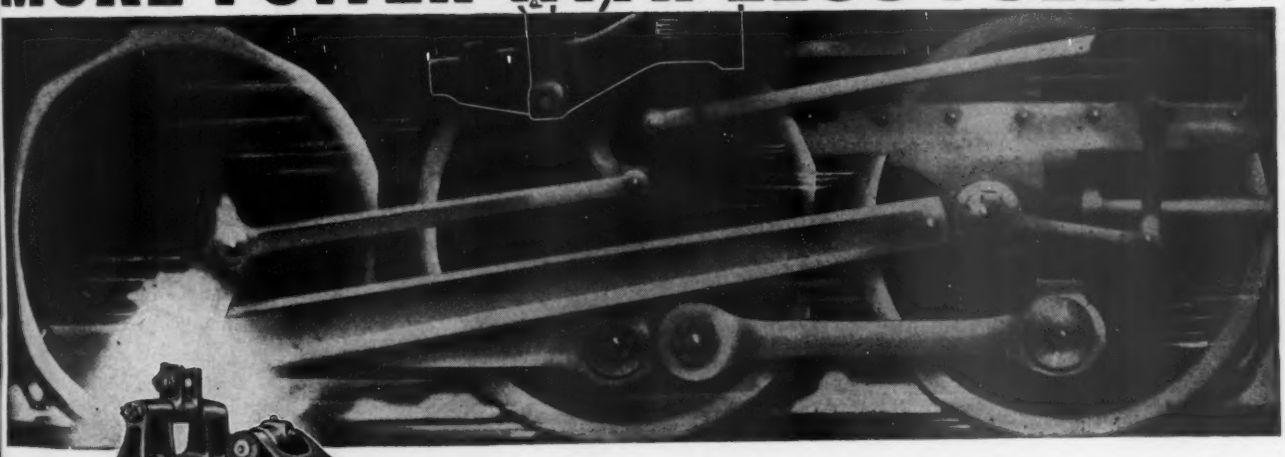
THE BRIDGEPORT SAFETY EMERY WHEEL CO., INC., BRIDGEPORT, CONN., U. S. A.

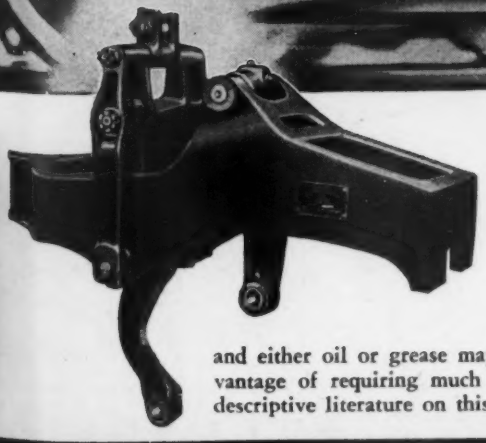
Bridgeport

GRINDERS • GRINDING WHEELS • BUFFING LATHES



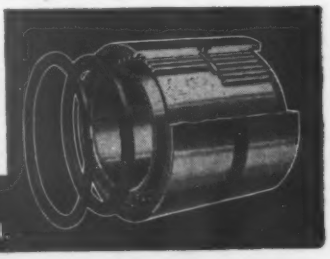
MORE POWER WITH LESS FUEL....



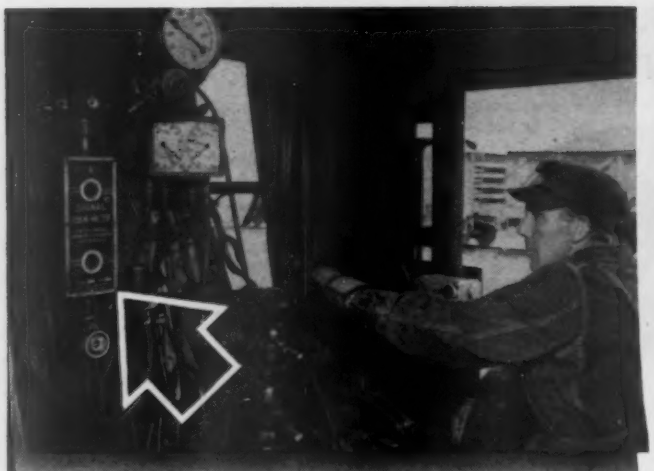


The new improved Baker Long Lap Valve Gear gives great improvement in starting, and makes it possible to maintain higher speeds with less fuel and water. The use of alloy steels has greatly reduced the weight of many parts of this valve gear, and equipped with McGILL *MULTIROL* Bearings the Baker Valve Gear frequently runs over 500,000 miles without attention.

The McGILL *MULTIROL* Bearings used in the Baker Valve Gear have great load carrying capacity. They are equipped with thrust washers for taking up lateral wear, and either oil or grease may be used in lubrication. They have the advantage of requiring much less oil than a bronze bushing. Write for descriptive literature on this newly redesigned Baker Valve Gear.



THE PILLIOD COMPANY
Factory—Swanton, Ohio
30 Church St., New York, N.Y.
310 S. Michigan Ave., Chicago, Ill.



PUT THE SIGNAL FOAM METER ON GUARD
Against Water Carry-over and Inefficient Blowdown

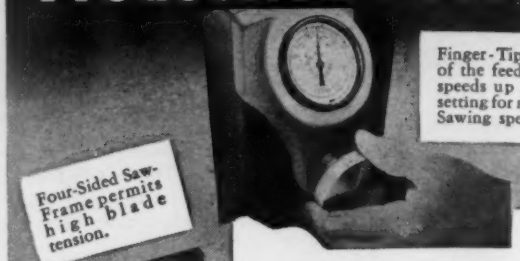
1. Installed in engine cab gives visual indication of foaming tendencies of boiler water.
2. Automatic valve blows down only when necessary.
3. Prevents delays en route.
4. Saves steam and increases boiler capacity.
5. Saves water so engine can go longer between stops.
6. Relieves engineman of blowdown job.
7. Reduces loss of heat, water, and chemicals due to excessive blowdown.
8. Permits extended washing periods, reducing washing costs and increasing boiler life.

WRITE for complete details. Modern locomotive installations include the Signal Foam Meter . . . always.

ELECTRO-CHEMICAL ENGINEERING CORPORATION
Subsidiary of Dearborn Chemical Company
Dept. RM, 310 S. Michigan Ave., Chicago 4, Ill.

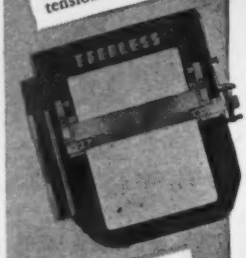
Electromatic
FOAM-COLLAPSING BLOWOFF SYSTEM

PEERLESS Features *That Boost* Production Records



Finger-Tip Control of the feed pressure speeds up accurate setting for maximum Sawing speeds.

Four-Sided Saw-Frame permits high blade tension.



Conveyor with automatic Micro-set Length Gauge can be added right on the job.

PEERLESS has exclusive features that help you make better production records on metal Sawing . . . Four-Sided Saw-Frame with Blade-Backing-Plate . . . Finger-Tip Feed Pressure Control . . . and Micro-set Length Gauge.

These are the principal features that give smooth, vibrationless Sawing at high speeds . . . top quality at lower cost! All your tough metal Sawing operations are greatly simplified when the work is planned for a Peerless Hydra-Cut. Find out today how these precision cutting tools—with all their exclusive features—can make better production records in your shop. See your local Peerless dealer or write direct for complete information.

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14" Hydra-Cut Saw in Consolidated Vultee Plant.

PEERLESS
MACHINE COMPANY
RACINE · WISCONSIN

BETTER WORK— WITH THE LUFKIN MASTER PLANER GAGE

The design and precision construction of the Lufkin Master Planer Gage permits its use on a greater number of jobs for which ordinary planer gages are unsuited. Accurately sets planer and shaper cutting tools within ¼" to 9" range. Perfect for use with gage blocks in setting up work on surface plate, with sine bar in grinding angles, with indicator for transferring measurements. An ideal adjustable parallel. For the precision tool of many uses, buy the Lufkin Master Planer Gage from your dealer. Write for free catalog. THE LUFKIN RULE CO., SAGINAW, MICH., New York City.

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PREVENT COSTLY DELAYS AND POSSIBLE DAMAGE TO ENGINES WITH AMERICA'S MOST WIDELY USED DIESEL NOZZLE TESTER

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NOZZLE TESTER

Keeps Diesel Engines Running Efficiently

To keep diesel engines operating at peak efficiency, this portable, precision-built Adeco Nozzle Tester is indispensable.

Light in weight yet built for heavy-duty service, it enables any mechanic to make quick accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Tests both large and small injectors, on bench or engine, at pressures up to 10,000 p. s. i. Prevents costly delays and possible damage to engine.

Ideal for testing hydraulic devices.

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Write for bulletin on this practical, low-cost unit.

TESTS FUEL INJECTORS AND HYDRAULIC DEVICES at Pressures up to 10,000 p.s.i.

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Loading and unloading wheel-sets and trucks on cars; removing and replacing them at repair tracks and shops; transporting to and from storage; positioning them in spots accessible only to a "live" boom crane; handling wheel-sets and trucks on narrow passage-ways, uneven roads, or under low overhead . . . these and many other wheel handling operations are easy going for the versatile, compact KRANE KAR. Send for Catalog #58. Agents in principal cities.
Users: AT&SF, Big Four, B&O, C&O, CB&Q, PRR, CP, GN, etc.

THE ORIGINAL SWING BOOM MOBILE CRANE
WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

2½, 5, AND 10 TON CAPACITIES

KRANE KAR
TRADE MARK REGISTERED
FOR RAILROADS

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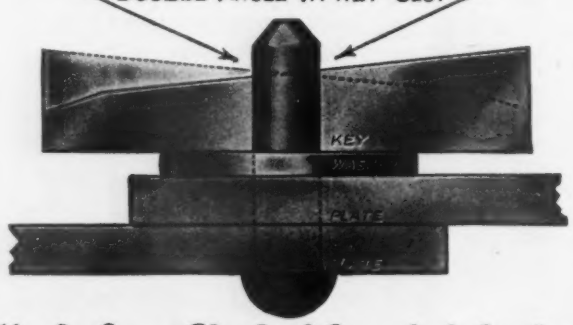
KEY BOLTS
FOR "FITTING-UP" PURPOSES
No Instructions Needed
DRIVE KEY FROM EITHER SIDE
DOUBLE ANGLE IN KEY SLOT



Made from Steel of Special Analysis
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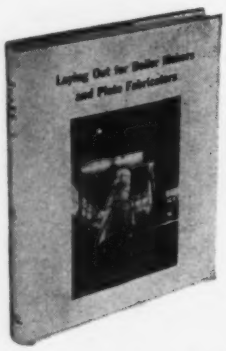
New Fifth Edition of

LAYING OUT for BOILER MAKERS AND PLATE FABRICATORS



1944. 5th. 522 pages, 762 scale drawings, 20 photographs, index, 8½ x 11¼, $8.00

This standard layout book, first published in 1907, has been thoroughly revised and brought up to date. The locomotive boiler chapters have been expanded and new chapters added to cover Laying Out and Computing Boiler Patches and Laying Out for Welded Construction. Original chapters on sheet metal layout have been left in and layouts for plate fabrication added. The text has been entirely reset in easy reading type and the all new line drawings are sharp and clear. Written in shop language and without resort to higher mathematics.

Contents

The Subject of Laying Out—Triangulation—Cones and Spheres—The Tubular Boiler—Laying Out the Locomotive Boiler—Constructing the Locomotive Boiler—Laying Out and Computing Boiler Patches—Laying Out for Welded Construction—Elbows—Layout and Construction of Steel Stacks—Transition Pieces and Breechings—Pipe and Pipe Connections—Chutes, Conveyors, and Hoppers—Index.

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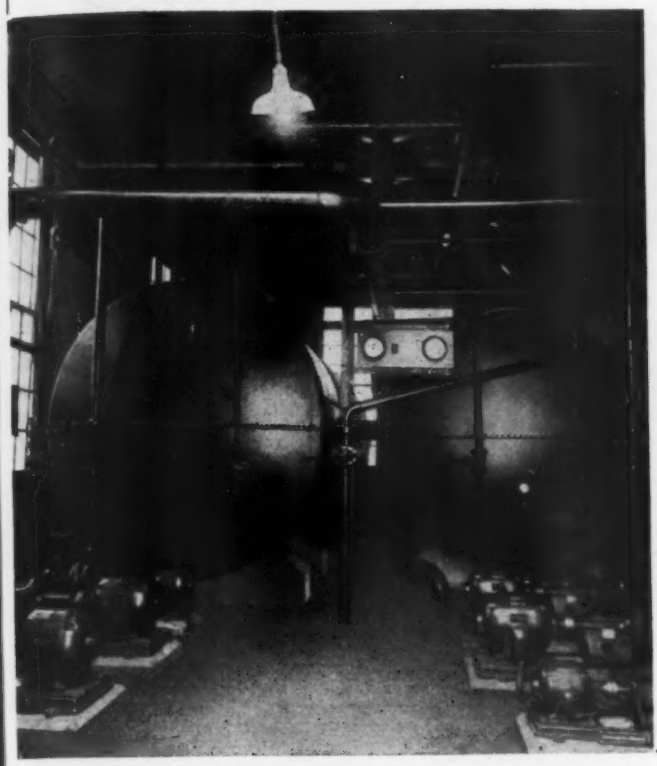
R. M. E. 11-45

MODERN BOILER WASHING EQUIPMENT



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"McQuade Hydraulic Bushing Press will pay for itself in three months, so railroads cannot afford to keep and use present, obsolete, screw-type devices." Shop Supt.

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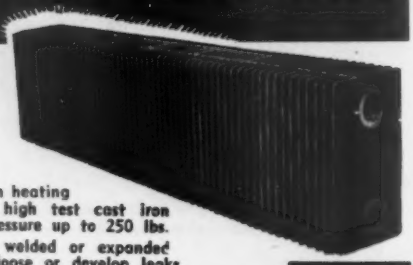
SULPHURIC FUMES

FROM ENGINES BEING FIRED UP CANNOT DESTROY

GRID UNIT HEATERS

and here's why →



- One piece construction heating sections (patented) of high test cast iron that withstand steam pressure up to 250 lbs.
- No soldered, brazed, welded or expanded connections to become loose or develop leaks.
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As one midwest railroad reports, "GRID Unit Heaters have been in our roundhouses for 8 years, without maintenance. They withstand sulphuric fumes from engines being fired up."

It's the material that makes the difference. Complete data upon request.

HIGH TEST CAST IRON HEATING SECTIONS

SEND Now for this new booklet "Corrosion in Unit Heaters"—free upon request.

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INDISPENSABLE FOR EVERY RAILROAD SHOP AND SERVICE DEPARTMENT . . . .

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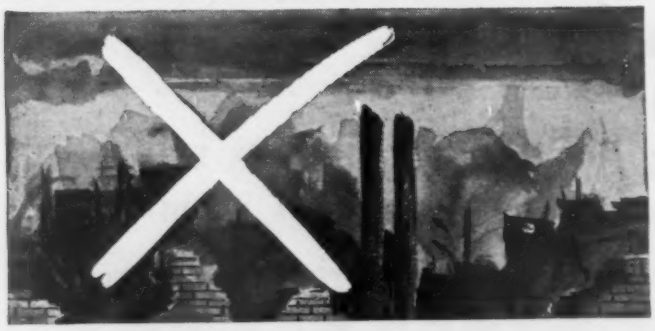

Marks the Spot!

Careless fires can be practically eliminated by the proper installation of Justrite Safety Products. They provide maximum protection for men and railroad equipment . . . and at a minimum cost.

JUSTRITE SAFETY GASOLINE CAN

The approved container for handling and storing flammable liquids. Handy to fill, pour and carry. Ruggedly built in sizes to fit your every need.

JUSTRITE OILY WASTE CAN

Furnished with or without foot lever opener. Top closes automatically. Built to smother waste material fires before they're started.

APPROVED FOR SAFETY The Justrite Safety Gasoline Can and the Oily Waste Can are approved for safety by Underwriters' Laboratories, Inc. and the Associated Factory Mutual Fire Insurance Companies. Ask your Supplier about Justrite Safety Products.

They're standard equipment on many railroads.

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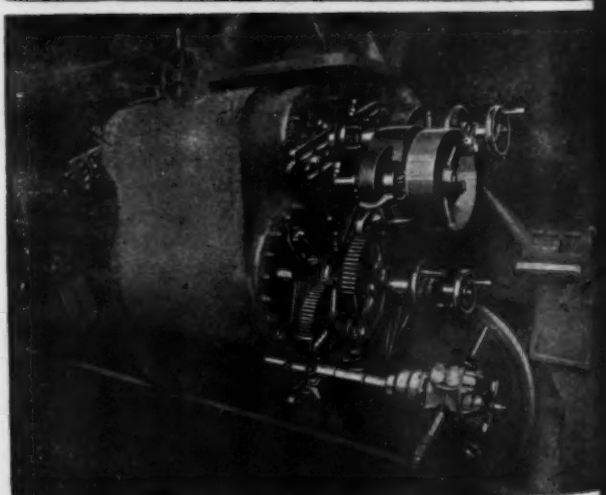

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OVER 30 YEARS

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PUNCHES
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Made from tough high grade, wear resistant ALLOY Tool Steel to assure longer service life.

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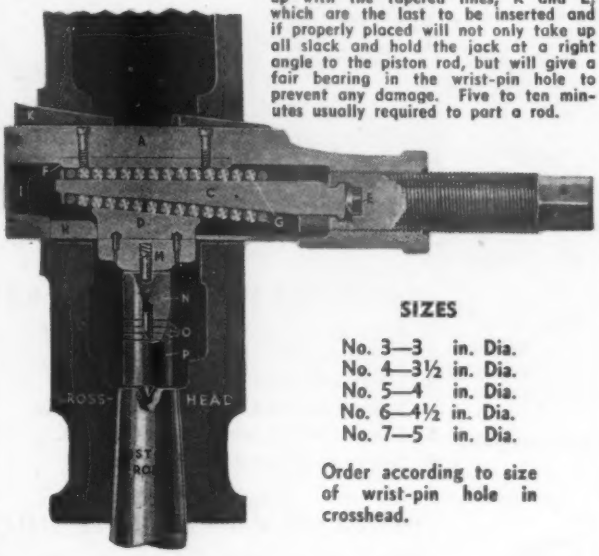
SMITH *Type A* PISTON PARTER



Operates as shown, in the wrist-pin hole. Filler blocks, N, O, and P take up the space between the parter and the piston rod. What slack may be left is taken up with the tapered lines, K and L, which are the last to be inserted and if properly placed will not only take up all slack and hold the jack at a right angle to the piston rod, but will give a fair bearing in the wrist-pin hole to prevent any damage. Five to ten minutes usually required to part a rod.

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No. 3—3 in. Dia.
No. 4—3½ in. Dia.
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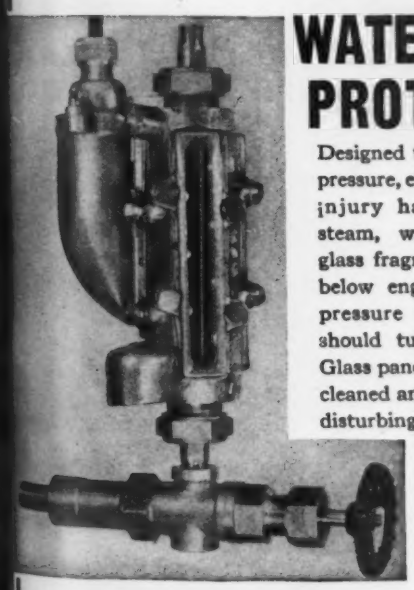
Order according to size of wrist-pin hole in crosshead.

SMITH DEVICES
331 N. FOURTH ST. PHILADELPHIA 6, PENNA.
WAL. 4274

NEW IMPROVED SARGENT
WATER GLASS PROTECTOR



Designed to withstand boiler pressure, eliminating personal injury hazard. Escaping steam, water and tubular glass fragments are diverted below engine deck through pressure tight connections should tubular glass burst. Glass panels can be removed, cleaned and replaced without disturbing steam connections.

Detachable electric lamp provides clear water-level vision at all times.

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Two Seat Gauge Cock
Water Columns complete
Quick Acting Blower Valve
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SIMPLEX Standard Speed Journal Jacks, as their name indicates, were originally designed for inspecting and renewing railway journal brasses. They are also widely used for bridge and structural work and for many other tasks where great lifting power in a compact jack is required. Simplex Journal Jacks are built to conform to the most rigid railroad specifications, with every part designed to render maximum service. Four sizes—all only 10" in closed height—capacities 15, 25, 35 and 50 tons.

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LEVER · SCREW · HYDRAULIC
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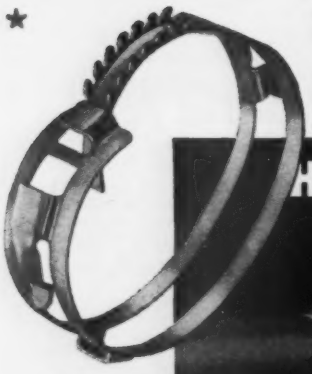
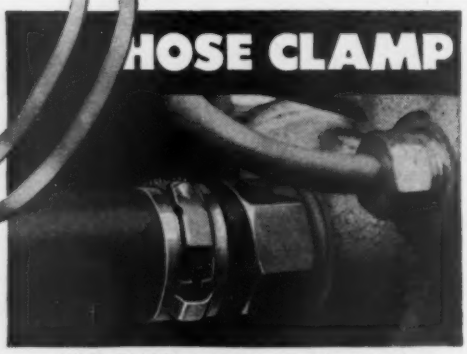
Templeton, Kenly & Co., Chicago (44), Ill.
Better, Safer Jacks Since 1899



The New TINNERMAN HOSE CLAMP



SPEED CLAMP on water valve of automatic home washer.

Latch by hand

Lock with pliers

Remove with screwdriver

SPEED CLAMP ADVANTAGES

1. One piece—no bolts, gears, thumbscrews.
2. Exclusive, self-locking, ratchet design.
3. Faster and easier to install or remove.
4. Uniform pressure provides leak-proof grip.
5. Low profile—no protruding mechanism.
6. May be used over and over again.

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TINNERMAN PRODUCTS, INC.
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Speed Nuts

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Protection all down the line JUSTRITE

Justrite Safety Products are standard equipment with many Railroads. Justrite Trainman's Lanterns and Justrite Inspector's Lanterns speed traffic in the yards and all along the right-of-way. Justrite Handy-Safety Flashlights are tops with RR Men everywhere. All are rugged, dependable and safe.

NOW! THE NEW JUSTRITE RR HEAD-LANTERN DESIGNED FOR OILERS AND PACKERS

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Shoulder and belt straps hold battery case in easy, comfortable position for carrying, leaving both hands free to speed-up maintenance service. The new RR work light that's . . . Justrite.

Ask your Supplier about Justrite Safety Products

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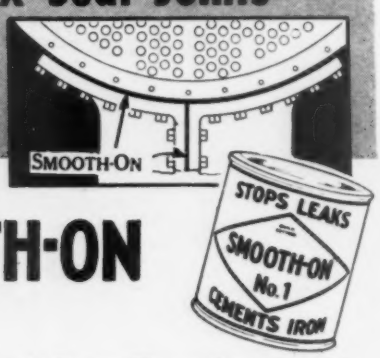
Smoke-Box Seat Joints Made Tight with SMOOTH-ON



Smooth-On No. 1 Iron Repair Cement fills openings completely, hardens into a tight, lasting seal, expanding slightly as it sets. Unaffected by heat or wide temperature changes.
Smooth-On packs stoker wings, anchors smoke-stack bases, stops leaks in water legs, plugs cylinder seams, fills cracks and rough cavities in castings, tightens loose bolts, rivets, fixtures. Order it in 1-, 5-, 25- or 100-lb. containers at your supply house—or direct from us if necessary.

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BENDING AND STRAIGHTENING MACHINES • ANGLE BENDERS

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THOMAS BAR SHEARS

AN INDISPENSABLE machine in the car shop for bar shearing operations. Of steel plate construction, and available in a number of sizes up to 3" diameter rounds.

Write for Bulletin 317, illustrating and describing machine in detail.

11

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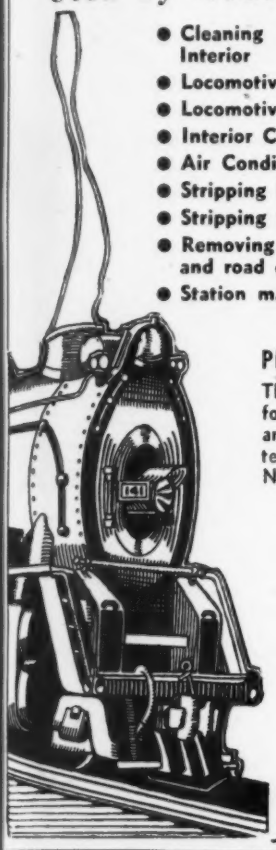
MACHINE MANUFACTURING COMPANY
PITTSBURGH, PA.

PERMAG Cleaning Compounds

Used by leading Railroads for



- Cleaning Passenger Car Exterior and Interior
- Locomotive Running Gear and Jacket
- Locomotive Tender and Cabs
- Interior Cleaning of Freight Cars
- Air Conditioning Units
- Stripping Paint Passenger Cars
- Stripping Coach Hardware
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- Station maintenance

PERMAG ASKEW car cleaner

The latest most outstanding product for removing Diesel oil film, dirt and grime from passenger car exteriors — painted or stainless steel. Never injures finish or body color.

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MAGNUSON Products Corp.

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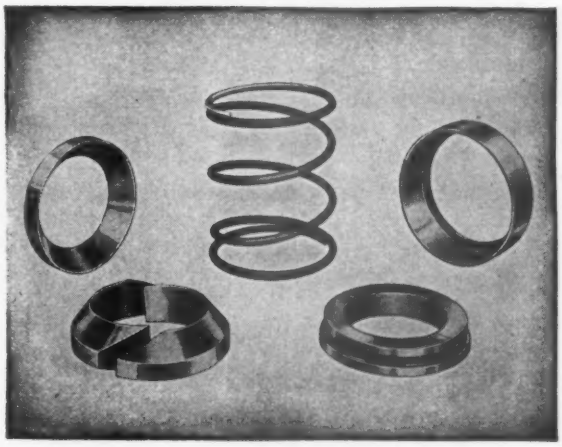
KING PACKING PARTS of Standard Design



RINGS

SPRINGS—SLIDING PLATES

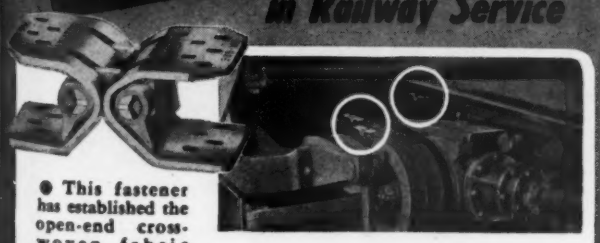
RETAINERS—SHELLS

The U. S. Metallic Packing Company

PHILADELPHIA 23, PA.

Representative in *Canada:* Joseph Robb & Co., Ltd., *Montreal*

ALLIGATOR V-BELT FASTENERS in Railway Service



● This fastener has established the open-end cross-woven fabric V-belt as a drive with many advantages over both flat belts and endless V-belts for many railway services. The exclusive separable hinge joint of Alligator V-belt Fasteners saves time and makes it possible to quickly and easily install or remove the V-belts.

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Many roads are now using Alligator V-belt Fasteners. If you are not familiar with this latest development in V-belt fastening you should write for Bulletin V-205.

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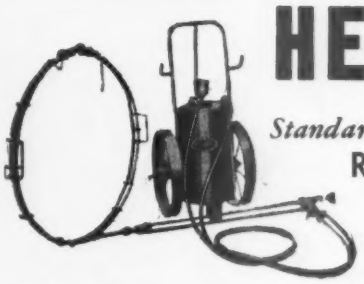

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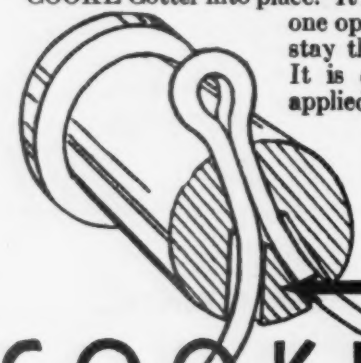

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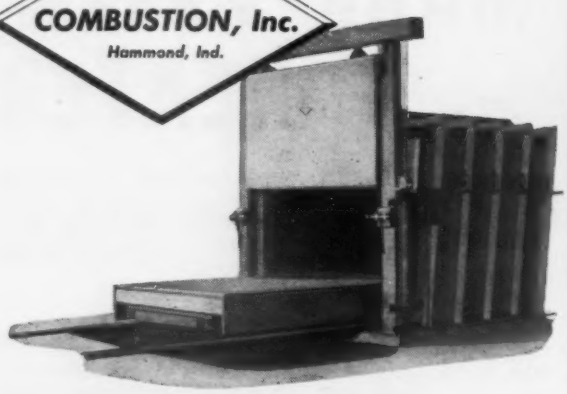

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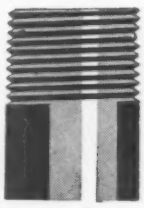

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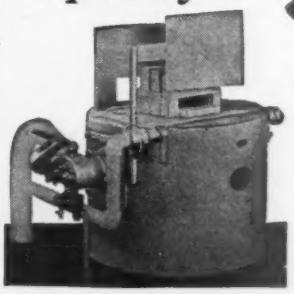

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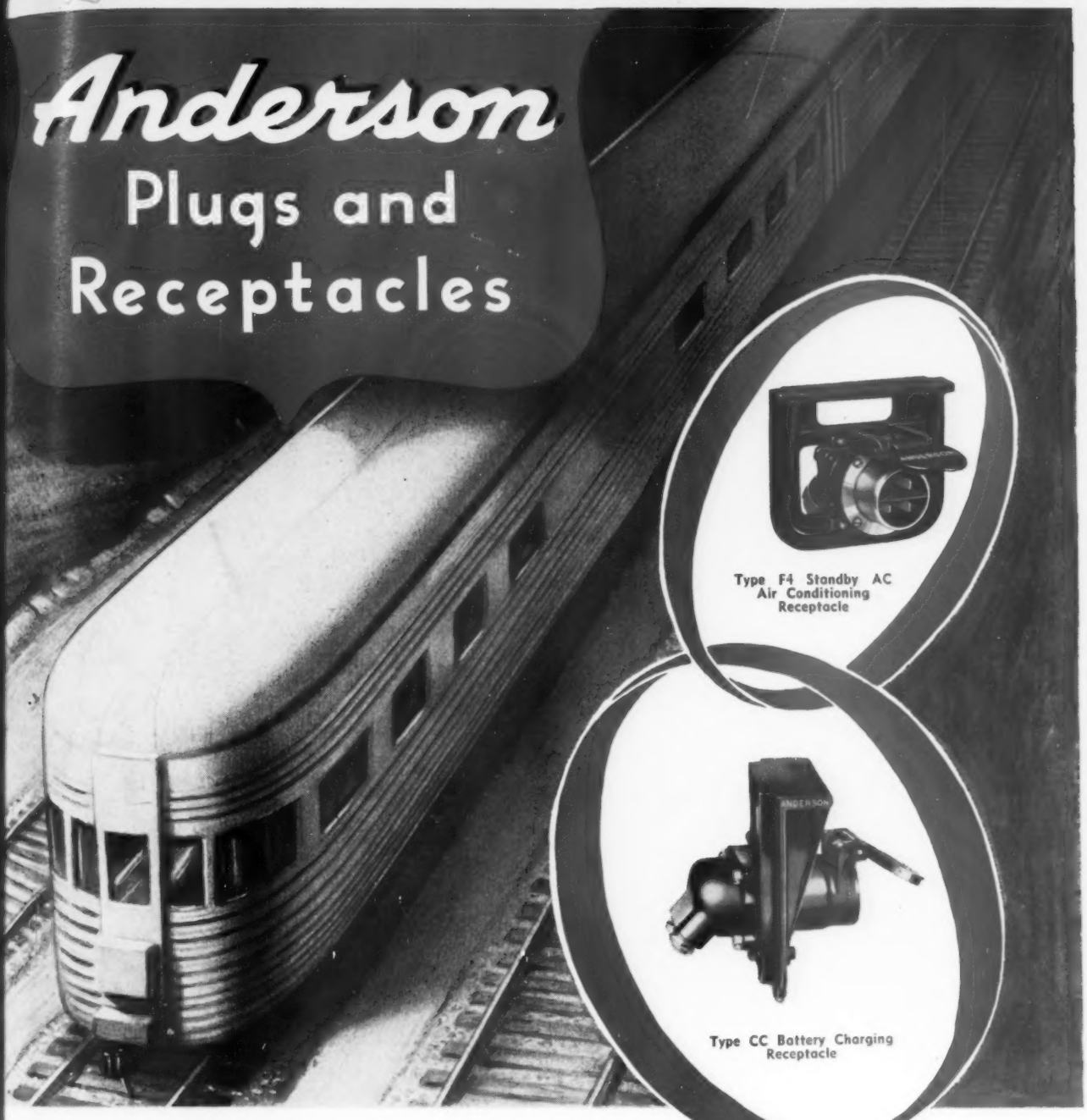

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